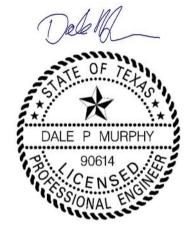
# CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS FOR THE SAN GABRIEL ELEVATED STORAGE TANK

## Prepared For:

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# CITY OF LEANDER TECHNICAL SPECIFICATIONS

## SAN GABRIEL ELEVATED STORAGE TANK

The following Sections of these Technical Specifications were reviewed by Robert Boswell, Certified NACE Level III International Coating Inspector, for the sole purpose of constructing the City of Leander San Gabriel Elevated Storage Tank Project.

09900 - Potable Water Tank and Mechanical Coatings

11/24/2021

#### SUMMARY OF WORK

## PART 1: DESCRIPTION

A. The work consists of the necessary labor, materials, equipment and supervision to construct a new 1.25 million-gallon composite elevated storage tank (EST), site improvements, retaining wall, site grading, paving, fencing and 24- and 36-inch water mains, including associated appurtenances, valves, and connections to existing water mains.

## PART 2: WORK SEQUENCE

A. The CONTRACTOR shall refer to the plans for specific work sequence requirement, and shall otherwise determine his own method of construction and detailed work sequence while observing all construction constraints and substantial and overall completion times are achieved. The CONTRACTOR shall properly coordinate his sequence of work and submit a detailed construction schedule to the Engineer for approval.

## PART 3: CONTRACTOR RESPONSIBILITIES

- A. Execute all work as defined in the plans and specifications.
- B. Arrange for the securing of any necessary permits not obtained by the OWNER and pay for the same.
- C. Arrange for necessary temporary water service and pay for this service and all water used during construction of the project.
- D. Provide adequate temporary sanitary facilities.

## PART 4: MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for this item.

SECTION 01011 MOBILIZATION

## SECTION 01011

#### **MOBILIZATION**

## PART 1: GENERAL

#### 1.01 SCOPE OF WORK

A. This item shall govern the mobilization of personnel, equipment and materials at the work site for other contract items that will be performed by the Contractor. Mobilization shall include, but not be limited to the movement of equipment, personnel, material, supplies, etc. to the work site; the installation of temporary facilities (when not paid for separately) and the establishment of office and other necessary facilities prior to the initiation of the Work.

## PART 2: PRODUCTS

## 2.01 GENERAL

A. This section covers the mobilization fo personnel, equipment, and materials at the work site for other cortract items that will be performed by the contractor.

#### PART 3: EXECUTION

#### 3.01 MEASUREMENT AND PAYMENT

A. "Mobilization" will be measured as a Lump Sum bid item.

**END OF SECTION 01011** 

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#### **ENVIRONMENTAL PROTECTION**

#### PART 1: GENERAL

## 1.01 SCOPE OF WORK

A. Construction of the Work covered by these Contract Documents is subject to the applicable provisions and rules of the Texas Commission on Environmental Quality (TCEQ) and United States Army Corps of Engineers and all other local applicable Federal, State, and Local laws, rules, regulations, ordinances, and conditions/requirements of permits issued by governmental agencies for the conduct of this project.

#### 1.02 RELATED SECTIONS

- A. 01300 Submittals
- B. 02105 Containment and Disposal of Waste
- C. 02225 Trenching, Backfilling, Embedment and Encasement
- D. 02530 Dewatering and Drainage of Excavations

## 1.03 SUBMITTALS

- A. Record Data Storage and Fueling Plan: for hydraulic fluid, oil, and fuel: Submit for approval by ENGINEER prior to bringing fuel storage on-site. Describe plan for fueling equipment and fuel storage including spill prevention, containment, and cleanup provisions. Provide a list of all equipment that will contain more than 55 gallons of hydraulic fluid, oil, or fuel. Provide drawings for the secondary containment systems pertaining to above ground fuel storage tanks, equipment-mounted fuel tanks, oil reservoirs, and oil and fuel lines (including hydraulic fluid lines). Provide a description on how secondary containment will be inspected. Provide a description on how fueling operations will be handled over or near a waterway, or on shore, describing environmental protection methods that will be implemented. Provide description for requesting additional fuel storage containers not included in initial request. Provide inspection form to be used on a weekly basis in evaluating these areas.
- B. Record Data Equipment Maintenance Plan: Describe plan for minimizing the potential environmental impacts of preventative and non-scheduled equipment maintenance activities. Describe what environmental protections measures will be implemented prior to and during both preventative and non-scheduled equipment maintenance activities.
- C. Record Data Equipment Inspection Reports: Provide inspection procedure and example inspection form to be used on a weekly basis to report equipment inspections.

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- D. Record Data MSDS: Provide MSDS data sheets on all proposed fuels, chemicals, paints greases, hydraulic fluids, coatings, epoxies, cements, admixtures, etc. to be used on and with equipment, to be used temporarily during construction, and to be permanently incorporated into the work.
- E. Record Data Materials used to perform the Work: Provide a list for the following types of materials that will be used in performing the Work.
  - 1) Ozone-depleted chemicals
  - 2) Materials with volatile organic compounds (VOC's)
  - 3) Any material that will become an F-Listed waste (e.g. acetone, xylene, toluene, methyl ethyl ketone).
  - 4) Acutely toxic materials.
  - 5) Constituents subject to reporting under the state and federal Right-to-Know regulations (as shown on the Material Data Sheets).
- F. Record Data Care of Water Plan: Describe plan for dewatering an area and managing water flows and infiltration into the work area. All water flows from, or generated by the work, must meet State and Federal regulations prior to entering a creek, stream or a lake. Regulations include, but not limited, to 30 TAC 307 and 26 TWC 121, Surface Water Quality Standards and Water Quality Control for the State of Texas respectively.
- G. Record Data Storm Water Inspections: Contractor to submit weekly storm water inspections to OWNER based on Storm Water Pollution Prevention Plan provided by Contractor.

## 1.04 PROTECTION OF LAND RESOURCES

A. The land resources, within the project boundaries and outside the limits of work under the Work of this Contract, shall be preserved in their present condition or be restored to a condition after construction that will appear to be natural and not detract from the appearance of the project. Activities shall be confined to areas defined by the Drawings and Specifications.

#### 1.05 PROTECTION OF WATER RESOURCES

- A. No water courses shall be polluted with any construction debris, loose soil, suspended sediment, petroleum products, abrasives, epoxies, paints, solvents, cleaners, fuels, surface preparation materials, oils, lubricants, bitumens, calcium chlorides, insecticides, herbicides, or other toxic materials harmful to life unless specifically permitted. Chemical emulsifiers, dispersant, coagulants, or other cleanup compounds shall not be used without prior written approval. It is the responsibility of the CONTRACTOR to insure compliance with state and local water quality standards and to identify if any additional discharge permits are required to perform Work.
- B. The CONTRACTOR may be required to submit a certified Spill Prevention Control and Countermeasures Plan (SPCC) that will fulfill the requirements of the Clean Water Act, CFR Part 112. In the event that the total capacity of all hydraulic fluid, oil, fuel containing tanks, containers, and equipment exceeds 1,320 gallons and if

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the project continues after 8/1/06 then an SPCC I required. The plan must be prepared prior to installing or mobilizing equipment that would cause the 1,320 gallon limit to be exceeded.

C. The CONTRACTOR will submit for approval all fuel storage containers, prior to mobilizing containers onto site, in accordance with Edwards Aquifer Rules (30 TAC 213). Additional fuel storage containers not approved in initial request must be individually approved by the ENGINEER.

#### 1.06 DEWATERING

- A. The CONTRACTOR will control and manage all dewatering of the project, and any non-storm water discharges from the construction site in compliance with all TCEQ water quality discharge requirements, including but not limited to 30 TAC 307, Surface Water Quality Standards for the State of Texas.
- B. Contractor shall provide continuous observation of dewatering activities and effectiveness of BMP's.
- C. The following non-storm water discharges from construction activities are acceptable.
  - 1) Discharges from fire fighting activities
  - 2) Fire hydrant flushings
  - Vehicle, external building, and pavement wash water where detergents and soaps are not used and where spills or leaks of toxic or hazardous materials have not occurred (unless spilled materials have been removed; and if local, state, or federal regulations are applicable, the materials are removed according to those regulations), and where the purpose is to remove mud, dirt, and dust
  - 4) Water used to control dust
  - 5) Potable water sources including waterline flushings
  - 6) Air conditioning condensate
  - 7) Uncontaminated ground water or spring water, including foundation or footing drains where flows are not contaminated with industrial materials such as solvents or other pollutants
- D. Dewatering and non-storm water discharges will, at a minimum, flow through silt fence, or other suitable structural controls, prior to leaving the site, as necessary to meet compliance requirements with all State and Federal water quality discharge requirements, including but not limited to 30 TAC 307 or 26 TWC 121, Surface Water Quality Standards and Water Quality Control for the State of Texas respectively.
- E. Dewatering of water contaminated with hydrocarbons or other oils is prohibited from being discharged to a creek, stream, lake, or the soil surface.

#### 1.07 PROTECTION OF AIR QUALITY

A. All Work shall be performed in such a manner as to ensure that air quality is protected. CONTRACTOR will complete and maintain all records to support

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compliance with the applicable air quality standards including but not limited to 30 TAC 106.183.

#### 1.08 PROTECTION OF FISH AND WILDLIFE

A. All Work shall be performed and all steps taken to prevent interference or disturbance to fish and wildlife. Water courses or habitats outside the project boundaries shall not be altered or disturbed, without OWNER's written prior consent.

#### 1.09 BURNING OF DEBRIS

A. No debris or surplus materials may be disposed of by burning at the job site or at any other location.

## 1.10 INFORMATION REGARDING WASTES REQUIRED POST BID

A. Waste control measures shall be implemented during construction activities to prevent unauthorized release and ensure proper management of waste in accordance with Section 02105 – Containment and Disposal of Waste.

#### 1.11 PROHIBITED MATERIALS

- A. The CONTRACTOR is strictly prohibited from using any of the following types of materials that could generate waste in performance of the work.
  - 1) Asbestos, asbestos-containing material (ACM)
  - 2) Mercury containing material
  - 3) Surface coatings with lead, cadmium, chromium, or mercury
  - 4) PCB containing material
  - 5) Radioactive containing material

#### 1.12 ENVIRONMENTAL INSPECTIONS

- A. The OWNER reserves the right to perform environmental inspections. The CONTRACTOR shall provide remedial action as required by the OWNER.
- PART 2: NOT USED

## PART 3: EXECUTION

## 3.01 EROSION CONTROL DURING CONSTRUCTION

A. The CONTRACTOR shall utilize the Best Management Practices (BMP's) with regard to controlling erodible soils within the construction lay-down area, project site, and while working near water, or water courses. This may include installing and maintaining silt fences or other similar structural controls as prescribed within the Storm Water Pollution Prevention Plan or additional controls as needed for any erodible soil, or storage of materials within the lay-down area and work site.

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#### 3.02 STORM WATER POLLUTION PREVENTION PLAN SWPPP

A. Implementation of the SWPPP is required. The CONTRACTOR will provide the SWPPP for the project, the CONTRACTOR shall perform all actions required within the SWPPP in relation to day to day on site activities including: weekly inspections of controls, and maintenance to sediment and erosion controls based on inspection records. Contractor shall provide a copy of the inspection records to Owners Representative on a weekly basis beginning with first required inspection, in addition, CONTRACTOR will maintain records in accordance with Texas Pollution Discharge Elimination System requirements.

## 3.03 PLACEMENT OF TEMPORARY PLATFORMS AND ACCESS FACILITIES

A. Temporary platforms or other temporary access facilities may be placed for temporary construction access to perform required Work. All placements of temporary platforms shall be conducted in accordance with the terms and general conditions of the U.S. Army Corps of Engineers Nationwide Permit Program and other environmental compliance requirements specified herein.

## 3.04 PREVENTIVE MAINTENANCE, FUELING, AND SPILL CONTAINMENT

- A. Scheduled preventive maintenance shall be performed on all construction equipment prior to mobilization in the work area. CONTRACTOR shall establish a maintenance area within the staging area for performing all routine and preventative maintenance, when possible. CONTRACTOR shall thoroughly inspect all construction equipment for any leaks prior to use at the job site and on a daily basis.
- B. A spill can be defined as an accidental release of a solid, liquid, or gas to land, air, or water that would create a potential or actual hazard to human health or the environment.
  - The CONTRACTOR is solely responsible for any spills or release caused by 1) himself or any of his subcontractors that occur during the performance of, or in connection with the performance of the Work under this Contract. The CONTRACTOR shall be responsible for all notifications required by any federal, state, or local law or regulations. The CONTRACTOR shall immediately notify the OWNER of the nature and location of any spill. The CONTRACTOR shall provide a written report to OWNER that identifies the substance, quantity released, location of the spill, agencies notified/talked to if any, cleanup and remediation activities conducted or planned. The written report should be a narrative that summarizes on the scene activity, remediation efforts, and if long term remediation will be required. This initial report shall be provided to the OWNER within 24 hours after the incident. Follow up reports may be required if requested by the OWNER. These requirements are also required if the spill occurs off the OWNER's property as a result of contractors performance of the Work under this Contract.
  - 2) The CONTRACTOR shall be liable for, and agrees to indemnify and hold the OWNER harmless from any and all liabilities, including, but not limited to, remediation costs, fines, penalties, court costs, and attorney fees resulting

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- from spills, releases, improper handling and/or disposal of wastes connected with a spill by the CONTRACTOR.
- 3) Spills shall be cleaned up to background levels or to criteria as set forth in the applicable federal, state, or local laws and regulations, or whichever is the most stringent.
- C. The CONTRACTOR shall provide a temporary secondary containment berm with plastic liner around all stationary construction equipment subject to potential leakage of fluids or fuel to contain accidental leakage and/or discharges. Detection and cleanup of liquid fuel, oil leaks, or spills, shall be accomplished as follows.
  - 1) Leak Detection: Leaks from any tanks or lines on equipment shall be detected by the CONTRACTOR during a daily check. Any fuel, oil, or chemical leak shall be reported immediately verbally and then in writing, in the appropriate format, to the OWNER's Resident Representative. The CONTRACTOR shall ensure that the source of the leak is repaired and that the spilled fluid is cleaned up immediately and thoroughly.
  - 2) Leak Cleanup: The CONTRACTOR shall be responsible for all spill cleanups and notify OWNER's Resident Representative immediately. Any fuel, oil, or chemical leakage shall be collected in the bermed area surrounding the equipment using absorbent material. Contractor shall keep absorbent materials on site for clean up. Contaminated absorbent materials shall be disposed of in accordance with Section 02105 – Containment and Disposal of Waste.
  - 3) Oil Filters: Used oil, oil filters, and cartridges shall be collected by the CONTRACTOR and these items will be recycled at an OWNER approved and audited recycling facility.
  - Operation of Equipment in Areas Subject to Direct Discharge to Waterways: 4) Special precautions shall be taken to prevent releases of fuel, oil or chemicals when equipment is working over or adjacent to the water. This shall include provision of secondary containment for equipment-mounted fuel tanks, oil reservoirs, and fuel and oil lines (including hydraulic fluid lines). Exposed hydraulic lines shall be double wrapped and/or shielded by the use of deflectors, as necessary, to prevent a release to the water in the event of a line rupture. No fuel container larger than 250 gallons shall be stored onsite outside of the staging area designated on the construction drawings, unless prior written approval by the owner. Fueling of equipment over or adjacent to water shall be done using a maximum fuel storage/transfer container size of five (5) gallons. A funnel shall be used to minimize fuel spillage, and a drip pan shall be used to capture any spillage of fuel. If the total quantity of containers smaller than five gallons on a barge, platform, walkway, or structure exceeds five (5) gallons, then these multiple items shall be kept in secondary containment while in storage.
- D. The CONTRACTOR should attempt to use and work with the least amount of chemicals or fuels needed for a given job.

#### 3.05 NOISE CONTROL

A. The CONTRACTOR shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be

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equipped with appropriate sound muffling devices and operated in a manner to cause the least noise consistent with efficient performance of the Work.

## 3.06 EQUIPMENT HYDRAULIC SYSTEMS

A. All hydraulic systems and lines on CONTRACTOR's equipment should be evaluated to determine if vegetable-based or environmental friendly hydraulic oil can be utilized over waterways. Vegetable-based or environmental friendly hydraulic oil is required if equipment manufacturer allows replacement of standard hydraulic oils. Provide MSDS sheets on the proposed hydraulic fluids. All hydraulic systems shall be double wrapped with absorbent materials or use deflective devises.

## PART 4: MEASUREMENT AND PAYMENT

#### 4.01 GENERAL

A. Erosion & Sedimentation Controls and Tree Protection, including Silt Fence, Rock Berm, Soil Retention Blanket, Reseeding, per Lump Sum.

**END OF SECTION 01014** 

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#### CONTRACTOR USE OF THE PREMISES

PART 1: GENERAL

#### 1.01 SCOPE OF WORK

- A. The CONTRACTOR shall not begin construction until all erosion and sedimentation control devices shown on the plans and related to the portion of the work have been installed, a preconstruction meeting at the site has been held per the plans, and the inspector has approved the erosion and sedimentation controls.
- B. Spoil material to be used on the job shall be stored within the limits of construction shown on the Plans. Trash, material unsuitable for fill and spoil material shall be permanently disposed of offsite. The CONTRACTOR shall take care not to cause mud, dirt and dust to be carried off the site. When construction is complete the site shall be fully restored and cleaned up of all trash, debris and contaminated soils due to chemical spills or other similar products. No burning on-site is permitted.
- C. All workers employed by the CONTRACTOR shall have such skill and experience as will enable them to properly perform the duties assigned them. Any person employed by the CONTRACTOR or a subcontractor who, in the opinion of the OWNER'S REPRESENTATIVE, does not perform his work in a proper and skillful manner, or who is disrespectful, intemperate, disorderly, or otherwise objectionable, shall at the written request of the OWNER'S REPRESENTATIVE be forthwith discharged and shall not be employed again on any portion of the work without the written consent of the OWNER'S REPRESENTATIVE. The CONTRACTOR shall furnish such suitable machinery, equipment, and construction forces as may be necessary, in the opinion of the OWNER'S REPRESENTATIVE, for the proper prosecution of the work, and failure to do so may cause the OWNER'S REPRESENTATIVE to withhold all estimates which have or may become due or the OWNER may suspend the work until his requests are complied with.
- D. All work within temporary or permanent easements shall conform to any and all restrictions, conditions, and/or requirements as may be set forth in the related specific easement documents. Easements secured for this project are shown on the plans and will be presented to the CONTRACTOR.
- E. All work within staging and storage areas obtained by CONTRACTOR shall conform to all requirements of these specifications.

#### 1.02 PUMP STATION SITE

A. Contractor is permitted to use portions of the San Gabriel East Pump Station site on a limited basis, as shown by the allowable staging areas on the plans. Use of the site shall be limited to passenger vehicles and limited crane deliveries and setups, as approved by the OWNER. Contractor shall coordinate with the OWNER

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at least two weeks prior to mobilizing equipment onto the existing site. Access to the pump station shall be maintained at all times.

## 1.03 NOTIFICATION OF PROPERTY OWNERS

- A. Unless otherwise indicated, the CONTRACTOR will notify property owners abutting the right-of-way or easements, or otherwise that will be affected by construction activities, of impending construction. The CONTRACTOR shall exercise diplomacy and tact with individual property owners. The CONTRACTOR shall specifically designate a single responsible individual that will be responsible for the giving of notifications to the affected property owners or tenants in accordance with this section. The OWNER will have the right to approve the responsible individual and may ask that they be replaced at anytime.
- B. CONTRACTOR shall give to property owners or tenants 48 hours notice prior to initiating work in their vicinity (within one city block or otherwise which might be affected by the work. Such notice shall be at a minimum presented by door hangers, the language on which shall be previously approved by the OWNER. The notice shall include a general description of the work to be accomplished, a direct contact name and local phone number for either the CONTRACTOR's superintendent or the employee responsible for the giving of notices, the name and phone number of the OWNER's onsite inspector, a general and accurate schedule identifying the time anticipated for the work and any other information pertinent to the work. Once notices are given, CONTRACTOR shall focus on completing that phase of work within the duration given. Subsequent notices may be required, at the sole discretion and direction of the OWNER, should the CONTRACTOR fail to complete the work within the identified schedule.
- C. Additional 48 hours notices shall be provided to property owners, or others that may be affected by the work, at the sole discretion and direction of the OWNER, for subsequent work activities or phases in the same area that occur beyond 10 working days of completing a work phase identified in an initial notice.

## 1.04 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

- A. Contractor shall protect, shore, brace, support and maintain all underground pipes, conduits, drains, and other underground facilities uncovered or otherwise affected by the Contractor's operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, sod, landscaping, irrigation, and other surface structures affected by construction operations shall be restored to their original condition, whether within or outside the easement/right-of-way. All replacements shall be made with new materials of equal appearance.
- B. Only trees marked on the plan to be removed may be removed. All other trees shall be protected against injury from construction operations. Tree protection shall be installed at locations as indicated on the plans. Whenever practicable, the Contractor shall utilize hand excavations to tunnel underneath large tree roots.
- C. Dust Control during construction shall be performed by the Contractor in a manner to minimize nuisance conditions and to the satisfaction of the Owner's

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- Representative. The Contractor shall provide a dust control system for trenching operations. No direct payment will be made for dust control.
- D. On a daily basis the Contractor shall sweep all streets, driveways and parking areas on which trenching, excavating, pipe laying or other dust generating activities occur. A street sweeper containing a dust control system shall be maintained on the project site at all times that trenching, excavating, pipe laying or other dust generating activities are ongoing.
- E. Hand excavate to tunnel under other underground obstructions.

## 1.05 TEMPORARY DRAINAGE PROVISIONS

A. Contractor shall be responsible for providing for the drainage of stormwater and such water as may be applied or discharged on the site in performance of the Work. Contractor shall construct temporary drainage facilities to handle, carry through, or divert around his Work all drainage flow, including storm flows to prevent silting of waterways or flooding damage to adjacent properties.

## 1.06 NOISE CONTROL

A. Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound level in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound-muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.

## 1.07 FENCES AND MAILBOXES

- A. All existing fences affected by the Work shall be maintained by the Contractor until completion of the work. Fences which interfere with construction operations shall be maintained with temporary fencing that shall be in place at nights/weekends and when the Work is not progressing at that site. The existing pump station site must be secured with fencing with a minimum height of 8 feet at all times.
- B. Contractor shall remove, reset temporarily, and replace permanently all mailboxes that are affected by the work. Access to mailboxes for delivery U.S. Mail shall be provided at all times. Temporary and permanent installations shall conform to the requirements of the United States Postal Service. Payment for removing and resetting of mailboxes will not be paid for directly, but will be considered subsidiary to the various bid items. Any damage to mail boxes or posts shall be the responsibility of the Contractor.

#### 1.08 WORK ON COMMERCIAL PROPERTIES

A. The CONTRACTOR shall maintain driveway access to all commercial properties during construction of mains and services. Work shall be phased to have a minimal impact on parking during construction. The CONTRACTOR shall

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coordinate with the property representative regarding the timing of parking space closures and timing of deliveries to the properties.

#### 1.09 MAINTENANCE OF TRAFFIC

- A. CONTRACTOR shall conduct his Work to have the least impact with vehicular and pedestrian traffic as is practicable. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether private or public, the Contractor shall provide and maintain suitable traffic control devices, detours, or other temporary measures to accommodate travel, and shall provide reasonable notice to owners of private drives prior to interfering with them.
- B. Safety and conveyance of traffic shall be regarded with prime importance. Unless otherwise directed, all portions of streets associated with this Project shall be kept open and provided a dust free, smooth and comfortable ride to traffic. In making open cut street/driveway crossings, the CONTRACTOR shall not block more than one-half of the street/driveway at one time without approval of the Owner.
- C. Prior to beginning Work, CONTRACTOR shall designate to the Owner a competent person who will be responsible and available to ensure compliance with the traffic control plans.
- D. The CONTRACTOR shall perform the necessary cleanup and temporary or final finishing immediately at the end of each day to fully reopen all streets and driveways. Temporary surfacing shall be provided where necessary to provide a smooth and safe ride in public streets and driveways.
- E. Where indicated on the traffic control plan, CONTRACTOR shall erect and maintain detours around construction activities.
- F. All traffic control devices shall be constructed and placed in accordance with the Texas Manual on Uniform Traffic Control Devices and the traffic control plans for the project. The Contractor shall be solely responsible for their placement and maintenance throughout the project.
- G. All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions, such as material piles and equipment shall be provided with similar warning signs and lights, and shall be illuminated with warning lights from sunset to sunrise.

## 1.10 EMERGENCY FACILITIES

A. Free access shall be maintained at all times to fire lanes and emergency and utility control facilities such as fire hydrants, fire alarm boxes, police call boxes, and utility valves, manholes, junction boxes, etc. In the event that it is necessary to make on of these facilities temporarily inaccessible, the Contractor shall obtain approval of such action. Contractor shall also provide at least 24 hours prior notice to the Fire Department, Police Department, and/or governing agency of the facility.

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B. Should a water line or gas line be broken by the Contractor during Work activities, or should other emergency conditions arise during the project, the following emergency notifications shall be immediately made by the Contractor.

Should a gas line be broken, the Contractor is to immediately notify the gas company owning the gas line and the following entities:

Leander Police Dept.528-2800Leander Fire Dept.528-2856Leander InspectorTo be providedLeander Public Works528-2760

Should a water line be broken, the Contractor is to immediately notify the following entities:

Leander Public Works 512-528-2760 Leander Inspector To be provided

PART 2: NOT USED

PART 3: NOT USED

PART 4: MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work described in this section.

**END OF SECTION 01015** 

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## GRADES, LINES AND LEVELS

#### PART 1: GENERAL

- A. The OWNERS survey crews will not stake for construction and will not be on site, except to perform quality control checks.
- B. The bench mark for horizontal/vertical control is noted on the Plans.
- C. The OWNER'S REPRESENTATIVE will meet with CONTRACTOR on site to point out controls at a mutually convenient date.

All Work shall be done to the lines, grades and elevations indicated on the drawings. Information concerning basic horizontal and vertical control points will be provided by the Engineer. These points shall be used as datum under this Contract. All work to transfer all controls for grades, lines, levels, layout and measurements shall be performed by the CONTRACTOR and require the approval of the Owner's Representative. The CONTRACTOR shall place grade stakes and establish construction staking layout sheets. The centerline and offset centerline stakes will be set at fifty (50) foot intervals and at points of alignment or grade changes. References to lines and grades as established by the CONTRACTOR's surveyor shall be in reference to these stake lines. The CONTRACTOR shall allow a minimum of ten (10) days after submission to the OWNER for approval of construction staking layout sheets. Construction layout sheets shall be in a format acceptable to the Owner's Representative. No Work shall be performed without OWNER approved construction staking layout sheets.

The CONTRACTOR shall provide a registered surveyor, an experienced instrument man, competent assistants, and such instruments, tools, stakes and other materials as required to complete the survey layout and measurement work to conform to the Texas Society of Professional Surveyors Manual of Practice for Land Surveying in the State of Texas, Category 5, Section 1-9 inclusive, and in a format to be established by the Owner's Representative. Prior to any excavation, the CONTRACTOR shall provide the elevation to top of ground at centerline of the pipe as well as cuts and offset stakes at the distance deemed appropriate by the CONTRACTOR to preclude disturbance of offset stakes during construction. In addition, the CONTRACTOR shall furnish, without charge, competent men from his force and such tools, stakes, and other materials as the Owner's Representative may require in establishing or designating control points, or in checking survey, layout, and measurement work performed by the CONTRACTOR.

The CONTRACTOR shall keep the Owner's Representative informed, a reasonable time in advance of the times and places at which he wishes to do Work, so that any checking deemed necessary by the Owner's Representative may be done with minimum inconvenience to the Engineer and minimum delay to the CONTRACTOR. Surveying will be coordinated between the Engineer and CONTRACTOR in a manner convenient to both.

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Any Work done without being properly located may be ordered removed and replaced at the CONTRACTOR's expense.

The Engineer will furnish control data, benchmarks and northing and easting coordinate values at PC's, PI's, PT's, and other control points as indicated on the construction Drawings. The CONTRACTOR shall carefully preserve all monuments, benchmarks, reference points, and stakes. In case of the destruction thereof, the CONTRACTOR shall be charged with the expense of replacement and shall be responsible for any mistake or loss of time that may be caused. Permanent monuments or benchmarks which must be removed or disturbed shall be protected until properly referenced for relocation. The CONTRACTOR shall furnish materials and assistance for the proper replacement of such monuments or benchmarks.

The CONTRACTOR shall satisfy himself before commencing Work as to the meaning and correctness of all control stakes, marks, etc., and no claim will be entertained by the OWNER for or on account of any alleged inaccuracies, unless the CONTRACTOR notifies the OWNER thereof in writing before commencing work thereon.

PART 2: NOT USED

PART 3: NOT USED

PART 4: MEASUREMENT AND PAYMENT

A. No separate payment will be made for this item.

**END OF SECTION 01050** 

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SECTION 01070 ABBREVIATIONS

#### **SECTION 01070**

## **ABBREVIATIONS**

PART 1: GENERAL

## 1.01 DESCRIPTION

A. The following abbreviations, in addition to those included in Division 0, whenever used in these Contract Documents, the intent and meaning shall be interpreted as follows:

AA Aluminum Association

AAMA Architectural Aluminum Manufacturers Association

AASHTO American Association of State Highway and Transportation Officials

ACI American Concrete Institute

AFBMA Anti-Friction Bearing Manufacturers Association

AGA American Gas Association

AGMA American Gear Manufacturers Association
AIMA Acoustical and Insulating Materials Association

AISC American Institute of Steel Construction

AISI American Iron and Steel Institute

AITC American Institute of Timber Construction
AMCA Air Moving and Conditioning Association
ANSI American National Standards Institute

APA American Plywood Association
API American Petroleum Institute

AREA American Railway Engineering Association ASAE American Society of Agricultural Engineers

ASCE American Society of Civil Engineers

ASHRAE American Society of Heating, Refrigeration and Air-Conditioning

**Engineers** 

ASME American Society of Mechanical Engineers
ASTM American Society for Testing and Materials

AWI Architectural Woodwork Institute

AWPA American Wood Preservers Association AWPB American Wood Preservers Bureau AWPI American Wood Preservers Institute

AWS American Welding Society

AWWA American Water Works Association

BHMA Builders Hardware Manufacturers Association
CBMA Certified Ballast Manufacturers Association

CDA Copper Development Association
CISPI Cast Iron Soil Pipe Institute

CLFMI Chain Link Fencing Manufacturers Institute
CMAA Crane Manufacturers Association of America

CRSI Concrete Reinforcing Steel Institute

CS Commercial Standard, U.S. Department of Commerce

ETL Electrical Testing Laboratories

Fed. Spec. Federal Specifications HI Hydraulic Institute

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SECTION 01070 ABBREVIATIONS

HMI Hoist Manufacturers Institute
ICBO International Conference of Building Officials
IEEE Institute of Electrical and Electronic Engineers

IEEE Institute of Electrical and Electronic Engineers IPCEA Insulated Power Cable Engineers Association

MIL- Military Specification (leading symbol)
MMA Monorail Manufacturers Association

MSS Manufacturers Standardization Society of the Valve and Fittings

Industry

NAPF National Association of Plastic Fabricators
NBHA National Builders Hardware Association

NEC National Electrical Code

NEMA National Electrical Manufacturers Association

NESC National Electric Safety Code NFPA National Fire Protection Association NGVD National Geodetic Verified Datum

NLMA National Lumber Manufacturers Association

NSF National Sanitation Foundation

NWMA National Woodwork Manufacturers Association

OECI Overhead Electrical Crane Institute

OFCI OWNER-furnished, CONTRACTOR-installed OFCR OWNER-furnished, CONTRACTOR-relocated

OSHA Occupational Safety and Health Act (both Federal & State)

PCA Portland Cement Association
PDI Plumbing and Drainage Institute

PS Product Standards Sections - U.S. Department of Commerce

RMA Rubber Manufacturers Association SAE Society of Automotive Engineers

SDI Steel Deck Institute SJI Steel Joist Institute

SMACNA Sheet Metal and Air Conditioning Contractors, National Association SPR Simplified Practice Recommendations, U.S. Department of

Commerce

SSPC Steel Structures Painting Council

TCA Tile Council of America

TEMA Tubular Exchanger Manufacturers Association

UBC Uniform Building Code

UL Underwriters' Laboratories, Inc.

WCLIB West Coast Lumber Inspection Bureau

WIC Woodwork Institute of California WWPA Western Wood Products Association

PART 2: PRODUCTS - Not applicable to this Section.

PART 3: EXECUTION - Not applicable to this Section.

**END OF SECTION 01070** 

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#### PROJECT MEETINGS

PART 1: GENERAL

## 1.01 SCOPE OF WORK

- A. This section describes the various project related meetings which will be held on a routine schedule throughout the duration of the project.
- B. The CONTRACTOR shall attend all project related meetings as indicated hereinafter. The CONTRACTOR's representatives, as a minimum, shall include his Project Manager and Construction Site Superintendent. Other CONTRACTOR representatives may attend project related meetings; however, a limit of four (4) representatives at any one meeting is mandatory unless the Owner's Representative approves a larger number.
- C. The CONTRACTOR shall provide all pertinent reports, copies of reports, etc., for each meeting as may be required by this or other sections of the Specifications.
- D. All project related meetings shall be held in the Owner's Representative office unless otherwise specified.
- E. The Owner's Representative will record the minutes of all meetings and will furnish all attendees and others, as necessary and appropriate, with copies within three (3) working days. The CONTRACTOR shall advise the Owner's Representative, in writing, of any inaccuracies, discrepancies, objections and or missing items in the minutes, within seven (7) calendar days or receipt of the minutes or by the next meeting, whichever is sooner.

#### 1.02 PRECONSTRUCTION CONFERENCE

- A. Prior to issuance of the Notice To Proceed, a Preconstruction Conference shall be held at a location, date and time designated by the OWNER. In addition to the OWNER's, ENGINEER's and CONTRACTOR's representatives the meeting shall be attended by the representatives of regulatory agencies having jurisdiction of the project, if required, and such other persons the OWNER may designate.
- B. Unless otherwise specified or agreed by the OWNER and CONTRACTOR, the CONTRACTOR shall present to the OWNER the written safety program, names of salaried specialists of CONTRACTOR and Subcontractors, and all other preconstruction documents required of him by the Contract at that time.
- C. In general, matters to be discussed and the instructions and information to be furnished to or given by the CONTRACTOR shall include:
  - 1) Project meeting schedule.
  - 2) Progress schedule and schedule of values submitted by CONTRACTOR.
  - 3) Communication procedures between the CONTRACTOR, OWNER and ENGINEER.

- 4) The names and titles of all persons authorized by the CONTRACTOR to represent and execute documents for him, with samples of all authorized signatures.
- 5) The names, addresses and telephone numbers of all those authorized by the CONTRACTOR to act for him in emergencies.
- 6) Construction permit requirements, procedures and posting.
- 7) Public notice of starting work.
- 8) Procedures concerning the installation of work on public or private property not owned by the OWNER.
- 9) Access and rights-of-way furnished by the OWNER.
- 10) Forms and procedures for CONTRACTOR's submittals.
- 11) Change order forms and procedures.
- 12) Payment application forms and procedures and the revised progress schedule reports to accompany the applications.
- 13) CONTRACTOR's safety and training program and designation of the CONTRACTOR's safety officer and his qualifications.
- 14) First-aid and medical facilities to be furnished by CONTRACTOR.
- 15) Contractor's provisions for barricades, traffic control, utilities, sanitary facilities, and other temporary facilities and controls.
- 16) Project sign for OWNER if required by the Specifications.
- 17) Inspector and his duties.
- 18) Construction surveyor and initiation of surveying services.
- 19) Testing laboratory or agency, and testing procedures.
- 20) Construction equipment and methods proposed by the CONTRACTOR.
- 21) Procedures for payroll and labor cost reporting by the CONTRACTOR.
- 22) Procedures to ensure nondiscrimination in employment on and for the work.
- 23) Issuance of the notice to proceed.
- 24) Use of site for construction, storage, staging, etc. and its interrelationship with other contracts.
- 25) Inventory of materials to be stored on site.

#### 1.03 PROGRESS MEETINGS

- A. Progress meetings shall be held throughout the duration of the project at the frequency determined by the Owner's Representative. The meetings shall be held on the same day and at the same time in an office, all to be determined at the preconstruction conference. In addition to the OWNER's, ENGINEER's and CONTRACTOR's representatives, the meeting shall be attended by other persons designated/requested by the OWNER, ENGINEER and/or CONTRACTOR.
- B. The format may include, but not necessarily be limited to, the following subjects:
  - 1) Review of previous meetings notes and update of pertinent information and project status.
  - 2) Identification and discussion of new job related construction problems. Such discussion will be toward resolving identified problems.
  - 3) Establishment of proposed construction activities for the upcoming month.
  - 4) Coordination with other contracts, including meeting with other contractors.

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## 1.04 OTHER MEETINGS

- A. Other meetings shall be held from time to time as may be requested by the CONTRACTOR, the ENGINEER or the OWNER. The time and place of the meetings shall be as mutually agreed upon. Those required to be in attendance at the meetings shall be as requested by that party requesting the meeting.
- B. Other meetings shall also include meetings with regulatory agencies. When requested, the CONTRACTOR shall attend meetings held or required by the governmental regulatory agencies having jurisdiction of the project.
- C. Other meetings shall also include post-construction conference. A post-construction conference shall be held prior to final inspection of the work to discuss and resolve all unsettled matters. The bonds and insurance to remain in force, and other documents required to be submitted by the CONTRACTOR, will be reviewed and any deficiencies determined. Schedules and procedures for the final inspection process and for the correction of defects and deficiencies shall be discussed and agreed.

PART 2: PRODUCTS - Not applicable to this Section.

PART 3: EXECUTION - Not applicable to this Section.

END OF SECTION 01200

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SECTION 01300 SUBMITTALS

#### **SECTION 01300**

#### **SUBMITTALS**

#### PART 1: GENERAL

## 1.01 SCOPE OF WORK

A. This Section specifies the general methods and requirements of submissions for Shop Drawings, Product Data and Samples, Record Drawings, and Construction Progress Schedules.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Contract Closeout: Section 01700

B. Technical Specifications: Division 2 thru Division 16

## 1.03 SHOP DRAWINGS, PRODUCT DATA, SAMPLES

## A. Shop Drawings

- Shop drawings, as defined in the Supplementary Conditions, and as specified in individual work Sections include, but are not necessarily limited to, custom-prepared data such as fabrication and erection/installation drawings, installation instructions, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the work
- 2) Within 14 days of the notice to proceed per section 01600 the CONTRACTOR shall submit to the Owner's Representative a "SUBMITTAL REGISTER" for review and approval. This register shall include, but is not limited to:
  - a) Listings of all submittals and samples;
  - b) Estimated date submittal will be transmitted;
  - c) Estimated procurement time for each item;
  - d) Blanks for dates transmitted, approved, and received for initial and follow-up transmittals.
- 3) All shop drawings submitted by subcontractors for approval shall be sent directly to the CONTRACTOR for preliminary checking. The CONTRACTOR

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SECTION 01300 SUBMITTALS

- shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.
- 4) The CONTRACTOR shall check all subcontractor's shop drawings regarding measurements, size of members, materials, and details to satisfy himself that they conform to the intent of the Drawings and Specifications. Drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission thereof.
- 5) All details on shop drawings submitted for approval shall show clearly the elevations of the various parts to the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.
- B. Product Data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data); manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare parts listing, and printed product warranties, as applicable to the work.
- C. Samples, as specified in individual Sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Owner's Representative for independent inspection and testing, as applicable to the work.
- D. Contractor's Responsibilities
  - 1) The CONTRACTOR shall review shop drawings, product data and samples prior to submission to determine and verify the following:
    - a) Field measurements
    - b) Field construction criteria
    - c) Catalog numbers and similar data
    - d) Conformance with the Specifications
  - 2) Each shop drawing, working drawing, sample and catalog data submitted by the CONTRACTOR shall have affixed to it the following Certification Statement, signed by the CONTRACTOR:

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SECTION 01300 SUBMITTALS

"Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements."

- 3) Submittals shall be organized by Specification Section when possible. Each submittal shall include a cover/transmittal sheet displaying the specification section(s) covered by the submittal.
- 4) The CONTRACTOR shall submit electronic PDF files of each submittal.
- 5) When submittals/shop drawings are returned for correction by the CONTRACTOR, the CONTRACTOR shall resubmit the complete submittal/shop drawing.

#### 1.04 RECORD DRAWINGS

- A. Record Drawings shall be maintained continually throughout the project by the CONTRACTOR. Record Drawings shall be reviewed with the Owner's Representative prior to submittal of monthly pay requests.
- B. Before final payment will be made, the CONTRACTOR must furnish the OWNER with one (1) set of Record Drawings.
- C. The Record Drawings shall be marked neatly in red showing all changes, additions or deletions to the Design Drawings to reflect the actual construction conditions.

## 1.05 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial progress schedule in duplicate within 10 calendar days after the effective date of the agreement and no later than the pre-construction conference.
- B. Submit revised schedules with each application for payment, identifying changes since previous version.
- C. Indicate estimated percentage of completion for each item of work at each submission.

PART 2: NOT USED

PART 3: NOT USED

#### PART 4: MEASUREMENT AND PAYMENT

A. Separate measurement or payment will not be made for Work required under this section.

#### **END OF SECTION 01300**

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#### PROTECTION AND PRESERVATION OF PRIMITIVE RIGHTS AND ANTIQUITIES

## PART 1: GENERAL

The Contractor shall take responsible precaution to avoid disturbing primitive records and antiquities of archaeological, paleontological or historical significance. No objects of this nature shall be disturbed without written permission of the Engineer. When such objects are uncovered unexpectedly, the Contractor shall stop all work in close proximity and notify the Engineer of their presence and shall not disturb them until written permission to do so is granted. All materials uncovered shall become the property of the owner of the land on which they are uncovered and shall be handled in accordance with all rules, regulations and laws governing the disposition of such materials.

If it is determined by the Owner, in consultation with the Texas Antiquities Committee, that exploration or excavation of primitive records or antiquities on the project site is necessary to avoid loss, the Contractor shall cooperate in the salvage work attendant to preservation. If the Engineer determines that the salvage work will increase the project cost or will delay the Contractors work, an appropriate change order shall be executed.

**END OF SECTION 01307** 

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#### PRE-CONDITION SURVEY

#### PART 1: GENERAL

## 1.01 SCOPE OF WORK

- A. The contractor shall conduct a thorough pre-construction site condition survey of the entire job. Site Condition Survey shall consist of photographs, and/or videotape recordings, and a report documenting the survey. Sufficient photographs supplemented by videotape shall be provided by the Contractor and submitted to the Engineer to resolve any damage claims from a third party, which may arise due to the construction of this report.
- B. Video and photographic survey shall include, but not be limited to, all residential buildings, commercial properties, government buildings, all access roads used to transport material or equipment to and from the project site, pavement, sidewalks, fences and other physical features.

## 1.02 RELATED WORK

A. Section 01010: Summary of Work

B. Section 01015: Contractor Use of the Premises

C. Section 01300: Submittals

## 1.03 QUALITY ASSURANCE AND CONTROL

A. The Contractor may, at Contractor's expense, retain the services of an independent third-part professional or company who will conduct detailed preconstruction inspections or survey documenting the condition of all private, commercial and public property located within the construction areas. Either the Contractor or the specialist shall have performed similar pre-construction survey services on projects of similar scope and complexity.

#### 1.04 SUBMITTALS

A. For submittal procedures refer to Section 01300: Submittals. See Execution Section below for additional requirements.

## PART 2: PRODUCTS (Not applicable for this Section)

## PART 3: EXECUTION

- A. Prior to construction, a site condition survey shall be made of all structures, streets, parking lots, retaining walls, curbs & gutters, landscape areas and other facilities located within the construction area. The survey shall include digital photographs of all work areas including public and private property. In addition to the photographs, the Contractor may provide a HI-8 or equivalent quality video of the work areas in DVD format. Pre-condition survey shall include the following:
  - 1) Existing cracks, structural defects, settlements, erosion, and any other unusual conditions occurring outside of the structures.
  - 2) Landscaping features, trees, and natural vegetation, as applicable, along collection and service line routes.
  - 3) Location and working condition of irrigation systems, invisible dog fences, and any other non-surface features.
  - 4) Transcribed notes and paragraphs to show the extent and location of any existing damage, deterioration and cracks shall document the condition of all portions of the structures.
- B. Contractor shall provide color digital photographs of high quality. If video is also provided, it shall be delivered in digital format on DVD. Auxiliary lighting shall be provided if needed to ensure that all filmed images are of the best quality possible. Photographs and HI-8 or digital videos shall include imprints of the survey date.
- C. Submit copies of all the correspondence with the property owners to the Owner's Representative prior to be beginning work.
- D. Prepare a report document, scope of work and conditions found during the preconstruction survey and submit. Reports shall include a review of the construction features of structure all survey reports containing field notes, sketches, diagrams, photos and videos. Reports must be signed and witnessed by all involved parties.
- E. The data obtained from the survey shall be delivered to the Owner's Representative within 7 days of the date of survey and prior to beginning work on the project.

## PART 4: MEASUREMENT AND PAYMENT METHOD

A. No separate payment shall be made for work described in this section. Work described in this section shall be paid for under the bid item for Mobilization.

**END OF SECTION 01335** 

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#### **TESTING LABORATORY SERVICES**

#### PART 1: GENERAL

## 1.01 SCOPE OF WORK

- A. Pre-construction testing to verify conformance of materials with the requirements of the specifications shall be performed and paid for by the CONTRACTOR. Testing results shall be submitted to the ENGINEER in accordance with Section 01300.
- B. The OWNER will employ and pay for services of an independent testing laboratory to perform QA/QC services specified in this Section. All other required tests shall be paid for by the CONTRACTOR, including tests required for gradation, concrete mix designs, asphalt mix designs, etc. See related Sections for specific requirements of the CONTRACTOR.
- C. Employment of a testing laboratory by the OWNER or the CONTRACTOR in no way relieves the CONTRACTOR of his obligation to perform the work according to the Contract.

#### 1.02 WORK INCLUDED

Testing is required for the following items of work:

- A. Soils compaction control.
- B. Cast-in-place concrete.
- C. HMAC Compaction Control

#### PART 2: TESTING LABORATORY

#### 2.01 DUTIES

- A. Cooperate with the ENGINEER and CONTRACTOR; provide qualified personnel promptly on notice.
- B. Perform specified inspections, sampling and testing of materials and methods of construction:
  - 1) Comply with specified standards; ASTM, other recognized authorities and as specified.
  - 2) Ascertain compliance with requirements of the Contract documents.

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- C. Promptly notify the ENGINEER and CONTRACTOR of irregularities or deficiencies of work which are observed during performance of services.
- D. Promptly prepare and distribute reports of inspections and tests as follows:

1) ENGINEER: 2 copies 2) CONTRACTOR: 2 copies 3) OWNER: 2 copies

#### 2.02 LIMITS OF AUTHORITY

The laboratory is not authorized to:

- A. Release, revoke, alter or enlarge on requirements of the Contract documents.
- B. Approve or accept any portion of the work.
- C. Perform any duties of the CONTRACTOR.

## PART 3: CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with laboratory personnel; provide access to the work or to manufacturer's operations.
- B. Provide to laboratory preliminary representative samples of materials to be tested in required quantities.
- C. Furnish copies of mill test reports.
- D. Furnish casual labor and facilities:
  - 1) To provide access to the work to be tested.
  - 2) To obtain and handle samples at the site.
  - 3) To facilitate inspections and tests.
  - 4) For laboratory's exclusive use for storage and curing of test samples.
- E. Coordinate/schedule all laboratory tests with 3<sup>rd</sup> party lab employed by the Owner. Notify the laboratory sufficiently in advance of operations to allow for his assignment of personnel and scheduling of tests.
- F. Arrange with the laboratory and pay for additional samples and tests required for the CONTRACTOR's convenience.
- G. CONTRACTOR to pay for any quality control test that fails and requires retesting of the material. Cost of such tests shall be deducted from final payment.

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## PART 4: MEASUREMENT AND PAYMENT

A. No separate payment shall be made for this item.

END OF SECTION 01410

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#### TEMPORARY FACILITIES

## PART 1: GENERAL

The facilities and controls specified in this section are considered minimum for the project. After obtaining approval, the Contractor can provide additional facilities and controls which he deems necessary for proper execution of the work and to meet his responsibilities for protection of persons and property. Contractor shall obtain all required permits for temporary facilities at his own expense.

## 1.01 BUILDINGS

- A. STORAGE. Provide watertight storage facilities of suitable size with floor above ground level for all materials susceptible to weather damage. Storage of other materials on blocks off the ground is acceptable. Place materials to permit easy access for inspection and identification.
- B. OTHER BUILDINGS. The location or building of structures or the erection of tents or other forms of protection are allowed as approved.

#### 1.02 UTILITIES

- A. JOB TELEPHONE. A cellular telephone will be acceptable provided the Contractor's superintendent (as specified in the General Conditions) shall be accessible by telephone at all times that work is in progress.
- B. TEMPORARY CONNECTIONS. Arrange and secure all temporary connections for water, electricity, gas and other services needed to do the work. The cost of connection and use is paid by the Contractor.

#### 1.03 SANITATION

Provide and maintain sanitary conveniences to satisfy requirements of local or state health authorities, ordinances, and laws. Obtain approval for location, secluded from public view.

#### 1.04 ACCESS ROAD AND PARKING

A. Access to the work site from Ronald Reagan Blvd. shall be provided by the Contractor at his expense. The Owner assumes no responsibility for the conditions or maintenance of any existing road or structure thereon that may be used by the Contractor for performing the work under these specifications for traveling to and from the site of the work. No direct payment will be made to Contractor for constructing temporary road and structures for construction operations, or for improving, repairing, or maintaining any existing road or structure thereon that may be used by the Contractor for performance of the work under these specifications. Contractor shall restore all temporary roads to their condition immediately prior to use by the Contractor. The cost of all work described in this paragraph shall be included in the prices bid in the other items of work. Access to

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the work site must be through a public right-of-way, or through a public easement. Crossing of lots except in the easements will not be allowed, unless contractor has obtained specific permission from the property owner. Access through Azul Lagoon Drive is prohibited to all construction traffic, aside from limited personal vehicles.

B. The access road along the right-of-way of San Gabriel Parkway will be constructed by the OWNER and provided as another access site. The Contractor is only responsible for maintaining this access road during the duration of construction.

#### 1.05 BARRICADES AND WARNINGS

- A. The safety of the public shall be regarded as of primary importance during construction. In all respects, provisions for public safety shall be the Contractor's responsibility.
- B. Should conditions be such that the public safety is involved, the Contractor shall provide warning lights which shall be kept burning between the hours of sunset and sunrise and the Contractor shall maintain a watchman on the site during these hours and during all other hours in which work is not in progress and the watchman's primary responsibility shall be to maintain the lights and warnings. Barricades and warnings shall be as approved by the Engineer.

## 1.06 SECURITY FENCING

A. Contractor shall install and maintain proper security fencing around existing pump station site at all times during construction. Fencing shall be 8 feet in height and meet requirements of TCEQ.

## 1.07 REMOVAL OF TEMPORARY FACILITIES AND CONTROLS

A. Prior to the final inspection remove all temporary buildings, storage facilities, sanitary conveniences, and signs. Disconnect all temporary utility connections. Clear the area of unnecessary safety items and temporary controls. Remove or restore, as required, all temporary roads and parking areas. Clean up the entire area as specified in the Section 01700.

PART 2: NOT USED

PART 3: NOT USED

PART 4: MEASUREMENT AND PAYMENT

B. No separate payment shall be made for this item.

END OF SECTION 01500

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#### PRESERVATION OF TREES

## PART 1: DESCRIPTION

1.01 This item shall consist of the proper protection, care and treatment of all trees and other vegetation in the vicinity of any construction activity.

#### PART 2: MATERIALS

- 2.01 Protective Fencing: Protective fencing refers to materials used to protect the root zones of trees. Three basic types of protective fencing materials shall be used as indicated. Type A and Type B are typical, and shall be installed where damage potential is high. Type C is to be installed where damage potential is minimal. Type C fence materials shall be subject to approval by the Engineer. It shall be replaced by Type A or Type B fencing at no expense to Owner if it fails to perform the necessary function.
  - A. Type A Chain Link Fence (Typical). Six-foot chain link fencing with tubular steel support poles.
  - B. Type B Wood Fence (Typical). Any planking; 4x4-inch for every fourth vertical support; 2x4-inch for intermediate vertical supports and horizontal stringers.
  - C. Type C Other Materials (Limited Application). The following materials will be permitted as alternates for limited application where free damage potential is minimal (as determined by the Engineer):
    - 1) Mesh type field fencing with fluorescent surveyor's flagging.
    - 2) High visibility plastic construction fencing. Fabric shall be 4 feet in width, made of high density polyethylene resin, extruded and stretched to provide a highly visible international orange, non-fading fence which will remain flexible from -60°F to 200°F, and be inert to most chemicals and acid. Pattern may vary from diamond to circular with a minimum weight per foot of 0.4 lbs/ft, a 4-foot-width minimum tensile yield strength (Horiz.) of 2000 psi, ultimate tensile strength of 2680 psi (Horiz.), and a maximum opening no greater than 2 inches.
    - 3) Other approved equivalent restraining material. All of the above fencing materials shall be supported with-steel pipe, tee posts, U posts or 2" x 4' timber posts, 5-1/2 feet in length minimum, spaced no more than 8 feet on centers. Fabric to be secured to post by bands or wire ties.
- 2.02 Trunk Protection Any 2 x 4-inch or 2 x 6-inch planking; plastic strapping.
- 2.03 Tree Dressing Any asphaltic tree wound paint.
- 2.04 Dry Wells Native stone, railroad ties or equivalent timber with PVC aeration systems in fill areas conforming to ASTM D-2729, SDR-35.

2.05 Paving - Permeable segmented pavers in conjunction with PVC pipe aeration system or concrete on gravel base with cored holes.

#### PART 3: CONSTRUCTION METHODS

## 3.01 Protective Fencing

All trees and shrubs in the proximity of the construction site shall be carefully checked for injuries prior to beginning any development activity.

All individual trees, shrubs, and natural areas to be preserved shall be protected during construction with temporary fencing as indicated.

Protective fences shall be installed prior to the start of any site preparation work (clearing, grubbing, or grading), and maintained in functioning condition throughout all phases of the construction project.

Protective fence locations in close proximity to intersecting streets or drives shall adhere to the site distance criteria found in Section 1 of the City of Austin Transportation Criteria Manual.

Protective fences shall be constructed at the locations (typically the outer limits of the Critical Root Zone) and with materials indicated to prevent the following:

- A. Soil compaction in the root zone area resulting from vehicular traffic or storage of equipment or materials.
- B. Root suffocation from excess fill or sedimentation accumulation (greater than four (4) inches).
- C. Feeder root loss due to minor grade lowering (two (2) to six (6) inches).
- D. Structural and feeder root loss due to major grade lowering (more than six (6) inches) or trenching.
- E. Wounds to exposed roots, trunks or limbs by mechanical equipment.
- F. Other activities detrimental to trees such as chemical storage, cement truck cleaning, and fires.

Exceptions to installing fences at the Critical Root Zone may be permitted in the following cases:

 Where trees are close to a proposed building or other construction activity, erect the fence to allow the minimum necessary work space between the fence and the structure and apply organic mulch to a depth of four (4) to six (6) inches in the unprotected root zone area;

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- 2) Where permeable paving is to be installed within a tree's Critical Root Zone, erect the fence at the outer limits of the permeable paving area prior to any site grading (no grading shall take place under permeable paving);
- 3) Where there are street-side pedestrian walkways, fences shall be constructed in a manner which does not obstruct safe passage;
- 4) Where there are severe space constraints due to tract size or other special requirements, the Contractor shall contact the Engineer to discuss alternatives.
- 3.02 Disinfection of Equipment Equipment, including backhoes and trenchers, used for trimming shall be disinfected after each red oak or live oak is completely cut and trimmed and before proceeding to the next tree. A solution of nine parts water to one part bleach shall be used for disinfection of all trimming equipment.
  - Where any of the above exceptions result in a fence being closer than five (5) feet to a tree trunk, the Contractor shall protect the trunk with strapped-on planking to a height of 8 feet (or to the limits of lower branching) in addition to the reduced fencing provided.
- 3.03 Tree Trimming Prior to the contractor initiating its work, the contractor shall secure an outside professional tree service to trim low hanging limbs within the defined limits of construction. Contractor shall submit qualifications of the tree service to the owner for approval. Low hanging branches of trees encroaching within the limits of construction may be trimmed to a height of 14 feet above ground surface and properly sealed prior to construction to prevent damage by construction equipment and operations.
- 3.04 Repair of Damage Tree roots scarred by equipment shall be cut cleanly and covered with top soil. When tree roots are pruned, a comparable portion of selected branches shall be cut from the tree on the opposite side. Limb pruning shall be made at the branch collar as indicated. All limbs greater than 1 inch in diameter shall be precut to prevent splitting. All cut limbs shall be treated with an approved tree dressing. Should any damage or destruction of any protected tree occur, the tree shall be evaluated by an arborist selected by the owner to determine the monetary damage to the tree and costs for remediation. The cost of the arborist and the cost of the remediation recommended by the arborist shall be the responsibility of the contractor.
  - All trees damaged during construction shall receive an application of fertilizer within the drip line conforming to a 20/20/20 fertilizer at the rate of 4 pounds per caliper inch.
- 3.05 Cutting and Filling Around Trees When an excavation or embankment is placed within the dripline of any tree greater than 8 inches in diameter, a dry well shall be constructed to protect the tree as indicated, when the cut or fill exceeds 8 inches.
- 3.06 Paving Around Trees Where paving is necessary within the dripline of any tree greater than 6 inch diameter, a permeable pavement and aeration system must be installed as indicated, except for street construction.
- 3.07 Tree Removal Any trees which are indicated for removal on the plans may be removed. Trees within the limits of construction, not shown on the plans, may be removed by the Contractor at their expense to facilitate construction with the permission of the OWNER's

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Representative. When a tree or shrub is determined to be removed, it shall be cut to a depth of 12 inches below the surrounding ground line. After removal, soil is to be placed in the hole to match the existing grade. After cutting the tree into pieces that can be managed, it will be removed from the site and disposed of. All work shall be conducted in such a manner as to protect all facilities, improvements and vegetation in the work area.

All damage resulting from tree removal or pruning shall be repaired at the Contractor's expense.

3.08 Final Cleanup - All temporary tree and shrub preservation measures shall be removed when the construction has been completed.

## PART 4: MEASUREMENT AND PAYMENT

4.01 No separate payment will be made for this item. Payment for tree protection is covered by specification item 01014.

**END OF SECTION 01535** 

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## PUBLIC SAFETY AND CONVENIENCE

PART 1: GENERAL

## 1.01 RELATED WORK SPECIFIED ELSEWHERE

A. General Conditions: Section 00700

B. Supplemental General Conditions: Section 00800

C. General Requirements: Division 1

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION

## 3.01 GENERAL

- A. CONTRACTOR shall maintain reasonable local vehicular and pedestrian dust free traffic, including use of driveways, to proceed safely with minimum inconvenience, except during actual construction operations. CONTRACTOR provided flaggers shall assist traffic when a street is operating under a single lane. Two-way traffic shall be maintained at all other times.
- B. CONTRACTOR shall maintain traffic by placing steel plates with Asphaltic concrete berms, temporary fill or bridging and temporary surfacing with cold-mix Asphaltic concrete paving.
- C. Sidewalks shall not be obstructed, except by special permission of the local government as applicable. Access to private dwelling and to commercial establishments shall be provided at all times.
- D. CONTRACTOR shall plan and execute his operations in a manner that will cause a minimum interference with traffic. The CONTRACTOR shall place and maintain in good condition, standard barricades at each end of the Project and at other locations where traffic is rerouted or blocked from using regular traffic lanes. Barricades and warning signs shall be in accordance with Texas Department of Transportation (TxDOT).
- E. Signs, barricades and warning devices informing public of construction features shall be placed and maintained by the CONTRACTOR who shall be solely responsible for their maintenance
- F. Neither explosives nor blasting shall be permitted on this Work.

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- G. The CONTRACTOR shall adhere to work hours and noise ordinances of the local government. Dust control shall be maintained at all times.
- H. Any private property damaged during the course of construction shall be immediately repaired or replaced to its original condition.

#### 3.02 TRAFFIC CONTROL

- A. It shall be sole responsibility of the CONTRACTOR to furnish, install, and maintain barricades, detour signs, warning signs, lights and all regulatory traffic control devices of the size and type specified, at locations indicated, or as directed or approved by the Owner's Representative.
- B. Throughout the life of the Contract, all existing roads and Traffic Control devices included in the Work shall be maintained by the CONTRACTOR to a condition, in the opinion of the OWNER, which is equal to or better than that which existed when Work commenced. Maintenance of existing roads and devices shall take priority over all other Work items and shall be subject to a seven-day-a-week, 24-hours-per-day time frame. The CONTRACTOR shall provide a smooth and safe riding surface for all vehicles traveling the posted speed limit along the route of this Project. This could include, but not be limited to, small cars, motorcycles, mopeds and bicycles. If the condition of the street surface deteriorates, for any reason, CONTRACTOR shall take necessary steps to insure immediate restoration.
- C. Maintenance work will not be paid for directly but will be considered subsidiary to various Bid items of this Contract.
- D. In the event that CONTRACTOR fails, in opinion of OWNER, to maintain a smooth surface for public comfort, fails to provide ingress and egress to private property, and/or does not provide and maintain proper traffic control devices, OWNER may provide these services and deduct any cost thereof, including overtime and administrative expenses, from all estimates thereafter due the CONTRACTOR. Such action by the OWNER shall not relieve the CONTRACTOR of his liability to protect the public at construction site.
- E. CONTRACTOR shall notify the Police Department, Fire Department, EMS, Williamson County, LISD, and the local government, as applicable, at least four Working Days in advance of beginning proposed Work with intention to close or partially block any street or any part thereof, or of any construction affecting free flow of traffic. The CONTRACTOR shall plan and adequately provide barricades and warning devices. The same parties shall be notified when normal traffic flow is restored.
- F. Should the CONTRACTOR, in his operations, reduce an existing two-way roadway to less than two-way traffic, CONTRACTOR shall provide flagging operations and route traffic through the construction area one lane at a time.

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- G. The CONTRACTOR's Flaggers shall be required any time it is necessary for the CONTRACTOR's equipment to move into or across an open traffic lane, or at other such times as directed by the Owner's Representative. A flagger shall be utilized to aid exit of hauling equipment from open traffic lanes to the Work area, and entry of hauling equipment from Work area to open traffic lanes. Flaggers shall be dressed and conduct operations in accordance with Texas Manual on Uniform Traffic Control Devices. CONTRACTOR shall provide English speaking flaggers. Flagging operations shall be the sole responsibility of the CONTRACTOR.
- H. The CONTRACTOR and Subcontractors shall confine their activities to the immediate area of the construction site and provide the following:
  - 1) Appropriate temporary fences, barricades, and/or Metal Beam Guard Fence if required, for site work involving excavation, utility extensions, remote construction work or other circumstances involving safety of public or protection of the work in progress.
  - 2) Warning lights at open trenches, excavations, etc., during hours from dusk to dawn each day. Protection of structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout and other hazards.

## 3.03 SPOILS DISPOSAL

CONTRACTOR shall submit a haul route plan including a map of the proposed route(s) for the ENGINEER's approval.

## 3.04 RESTORATION

- A. In order to minimize environmental and potential flood impacts, the sum of the amount of trench opened in advance of the completed line and the amount of trench left unfilled at any time shall be restricted to one (1) full block or 300 linear feet, whichever is less.
- B. Restoration shall be an on-going process during construction operations and shall immediately precede completion of construction of each successive section of the line, which shall not exceed 1,200 linear feet without approval of the ENGINEER.

## 3.05 STREET MARKERS AND TRAFFIC CONTROL SIGNS

It shall be responsibility of the CONTRACTOR to remove, preserve and reset, as required, Street Marker and Traffic Control Signs that are within construction limits to the line and heights as described in Texas Manual on Uniform Traffic Control Devices before any sidewalks or street excavation is begun. Signs shall not be laid on the ground. No payment will be made for this work but shall be considered subsidiary to the various Bid items. Any damage to signs or posts shall be paid for by the CONTRACTOR.

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## 3.06 BURNING PERMIT

No burning shall be allowed on site.

## 3.07 DRIVEWAYS

The approach grade of existing driveways shall not be modified unless specifically indicated on the drawings or directed by the Owner's Representative. Within the right-of-way, and outside the right-of-way, all driveways shall be replaced per existing conditions. Excavation, Flexible Base, Portland Cement Concrete and Asphaltic Concrete, used for driveways as prescribed above shall not be measured for payment but shall be considered subsidiary to various Bid items in the Contract unless payment is included as a separate Contract pay item.

## PART 4: MEASUREMENT AND PAYMENT

## 4.01 TRAFFIC CONTROL

A. No separate payment shall be made for work described in this section.

**END OF SECTION 01550** 

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## MATERIALS AND EQUIPMENT

## PART 1: GENERAL

## 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

## 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. Related Sections: The following Sections contain requirements that relate to this Section:

Section 01070 specifies abbreviations of industry standards to products specified.

Section 01300 specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.

## 1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
  - 1) "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 2) "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
  - 3) "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
  - 4) "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

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## 1.04 SUBMITTALS

- A. Product List: Prepare a list showing products specified in tabular form acceptable to the OWNER. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.
  - 1) Coordinate product list with the Contractor's Construction Schedule and the Schedule of Submittals.
  - 2) Form: Prepare product list with information on each item tabulated under the following column headings:
    - a) Related Specification Section number.
    - b) Generic name used in Contract Documents.
    - c) Proprietary name, model number, and similar designations.
    - d) Manufacturer's name and address.
    - e) Supplier's name and address.
- B. Initial Submittal: Within 14 days after date of Notice to Proceed, submit copies of an initial product list in accordance with Section 01300. Provide a written explanation for omissions of data and for known variations from Contract requirements.
  - 1) At the Contractor's option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.
- C. Completed List: Within 21 days after date of Notice to Proceed, submit copies of the completed product list in accordance with Section 01300. Provide a written explanation for omissions of data and for known variations from Contract requirements.
- D. ENGINEER's Action: The ENGINEER will respond in writing to Contractor within 2 weeks of receipt of the completed product list. No response within this period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. The ENGINEER's response will include a list of unacceptable product selections, containing a brief explanation of reasons for this action.

# 1.05 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed

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surfaces of products that will be exposed to view in occupied spaces or on the exterior.

- 1) Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
- 2) Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
  - a) Name of product and manufacturer
  - b) Model and serial number
  - c) Capacity
  - d) Speed
  - e) Ratings

# 1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
  - 1) Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
  - 2) Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3) Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4) Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
  - 5) Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

## PART 2: PRODUCTS

# 2.01 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.

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- 1) Provide products complete with accessories, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
- 2) Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
  - 1) Where Specifications specify products or manufacturers by name, accompanied by the term "or equal" or "or approved equal," comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
  - 2) Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
  - 3) Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
  - 4) Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.
  - 5) Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.

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## PART 3: EXECUTION

# 3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
- B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

# PART 4: MEASUREMENT AND PAYMENT

A. No separate payment shall be made for this item.

END OF SECTION 01600

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## CONTRACT CLOSEOUT

## PART 1: GENERAL

## 1.01 SCOPE OF WORK

A. This Section outlines the procedure to be followed in closing out the contract.

## 1.02 SUBSTANTIAL COMPLETION

A. The Substantial and Final completion dates for the contract shall be established as stated in the Bid Form.

#### 1.03 FINAL CLEANING

- A. At the completion of work and immediately prior to final inspection, cleaning of the entire project shall be accomplished according to the following provisions:
  - 1) The CONTRACTOR shall thoroughly clean, sweep, wash and polish all work and equipment provided under this Contract, including finishes. The cleaning shall leave the structures and site in a complete and finished condition to the satisfaction of the Owner's Representative and OWNER.
  - 2) The CONTRACTOR shall remove all temporary structures and all debris, including all dirt, sand, gravel, rubbish and waste material.
  - 3) Should the CONTRACTOR not remove rubbish or debris or not clean the buildings and site as specified above, the OWNER reserves the right to have the cleaning done at the expense of the CONTRACTOR.
- B. Repair, patch and touch-up any marred surfaces equivalent to the specified finish and to match adjacent surfaces, including repair or replacement of pavement, curb and gutter, and other surfaces marred by construction equipment.
- C. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly-painted surfaces.

## 1.04 FINAL INSPECTION

A. After final cleaning and restoration and upon written notice from the CON-TRACTOR that the work is completed, the Owner's Representative will make an inspection with the CONTRACTOR. Upon completion of this inspection, the Owner's Representative will notify the CONTRACTOR, in writing, of any particulars in which this inspection reveals that the work is defective or incomplete with a copy to the OWNER.

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- B. Upon receiving written notice from the Owner's Representative, the CONTRACTOR shall immediately undertake the work required to remedy deficiencies and complete the work to the satisfaction of the Owner's Representative.
- C. When the CONTRACTOR has corrected or completed the items as listed in the Owner's Representative's written notice, he shall inform the Owner's Representative, in writing, that the required work has been completed. Upon receipt of this notice, the Owner's Representative, in the presence of the OWNER and CONTRACTOR, will make another inspection of the project.
- D. Should the Owner's Representative find all work satisfactory at the time of this inspection, the CONTRACTOR will be allowed to make application for final payment in accordance with the provisions of the GENERAL CONDITIONS. Should the Owner's Representative still find deficiencies in the work, the Owner's Representative will inform the CONTRACTOR of the deficiencies in writing and will deny the CONTRACTOR's request for final payment until such time as the CONTRACTOR has satisfactorily completed the required work.

## 1.05 FINAL SUBMITTALS

- A. No application for final payment will be accepted until all of the following have been submitted as required in Section 01300, SUBMITTALS including, but not limited to, the following:
  - 1) Final shop drawings
  - 2) Record drawings
  - 3) All Operation and Maintenance Manuals
  - 4) All Equipment Manufacturers' Certificates of Proper Installation

## 1.06 ACCESSORY ITEMS

A. The CONTRACTOR shall provide to the OWNER, upon acceptance of the equipment, all special accessories required to place each item of equipment in full operation. These special accessory items include, but are not limited to, the specified spare parts, one year's supply of oil and grease, light bulbs, fuses, hydrant wrenches, valve keys, handwheels, chain operators for valve handles more than 6 feet above floor and other expendable items as required for initial startup and operation of all equipment furnished by the CONTRACTOR.

## 1.07 GUARANTEES, BONDS AND AFFIDAVITS

A. No application for final payment will be accepted until all guarantees, bonds, certificates, licenses and affidavits required for work or equipment as specified are satisfactorily filed with the Owner's Representative.

## 1.08 RELEASE OF LIENS OR CLAIMS

A. No application for final payment will be accepted until satisfactory evidence of release of liens has been submitted to the OWNER as required by the contract.

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# 1.09 FINAL PAYMENT

A. Final payment will be made to the CONTRACTOR in accordance with the contract and construction specifications.

END OF SECTION 01700

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## SUBSURFACE INVESTIGATION

## PART 1: GENERAL

## 1.01 SCOPE OF WORK

A. This section references the soil investigation report used to establish design controls for the project. The accuracy of the information contained therein is not guaranteed. It is the Bidder's responsibility to ascertain if additional information is available, to make arrangements to review same prior to bidding and make his own determinations as to all subsurface conditions. The soil investigation reports have been prepared by Fugro, Inc. The Contractor shall note that several geotechnical bores are not located along the proposed alignment for this project. A copy of these reports are attached to this specification for informational purposes only. Where there are conflicts between the geotechnical report and the drawings or specifications, notify the Engineer for clarification immediately.

## PART 2: RELATED WORK SPECIFIED ELSEWHERE

- A. Structural Excavation, Backfill and Compaction: Section 02220
- B. Dewatering and Drainage of Excavation: Section 02530.
- C. Trenching, Backfilling, Embedment and Encasement: Section 02225
- D. Trench Safety Systems: Section 02227

PART 3: NOT USED

## PART 4: MEASUREMENT AND PAYMENT

A. No separate payment shall be made for this item.

**END OF SECTION 02010** 

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## SITE PREPARATION

## PART 1: GENERAL

## 1.01 SCOPE OF WORK

A. Clearing and grubbing consists of removal and disposal of fencing, trees, stumps, brush, roots, vegetation, logs, rubbish and other objectionable matter within designated areas on the project site.

## PART 2: PRODUCTS

(Not applicable to this Section)

## PART 3: EXECUTION

## 3.01 CLEARING

- A. Remove trees, brush, stumps, roots, rubbish or other objectionable matter from the designated areas for a depth of six (6) inches over the entire site.
- B. Refer to owner's permit for limitations on periods approved for clearing.

## 3.02 REMOVING MATERIAL

- A. Burning of cleared and grubbed material at the site is not permitted.
- B. All material shall be removed from the site and disposed of per local codes.

## PART 4: MEASUREMENT AND PAYMENT

A. Clearing and Grubbing, Including the removal and disposal of all trees, stumps, brush, roots, shrubs, vegetation, logs, and rubbish, per Lump Sum

# **END OF SECTION 02100**

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## CONTAINMENT AND DISPOSAL OF WASTE

## PART 1: GENERAL

#### 1.01 SCOPE

A. This Section identifies specific areas involving environmental requirements that the CONTRACTOR must comply with in performing this Scope of Work. This will be done by complying with all applicable Federal, State, and Local Laws and Regulations concerning environmental pollution control and abatement, as well as the specific requirements in other portions of this contract for environmental protection.

## 1.02 RELATED SECTIONS

- A. 01300 Contractor Submittals
- B. 01014 Protection of the Environment

#### 1.03 APPLICABLE REGULATIONS AND REFERENCES

- A. The following documents are considered a part of this Specification. The CONTRACTOR shall direct any questions, such as the extent of applicability or apparent conflict to the OWNER for resolution. The revision in effect on the date when the Work is performed shall apply.
- B. United States Government
  - 1) National Ambient Air Quality Standards (NAAQS-40 CFR 50)
  - 2) Clean Air Act (CAA 40 CFR Subchapter C, "Air Programs" Parts 50 through 99)
  - 3) 40 CFR 50 "National Primary and Secondary Ambient Air Quality Standards"
    - a) Section 50.6 "Particulate Matter"
    - b) Section 50.12 "Lead"
  - 4) 40 CFR 58 "Ambient Air Quality Surveillance"
    - a) Appendix A"QA Requirements for State and Local Air Monitoring Stations"
    - b) Appendix E "Probe Siting Criteria for Ambient Air Quality Monitoring"
  - 5) Clean Water Act (CWA, as amended in 1972, 1977 and 1987 40 CFR Subchapter D, Parts 100 through 149)

- 6) 40 CFR 117 "Determination of Reportable Quantities of Hazardous Substances"
- 7) Resource Conservation and Recovery Act (RCRA 40 CFR 240 280)
  - a) 40 CFR 261 Subpart C "Identification and Listing of Hazardous Waste Characteristics"
  - b) 40 CFR 262 "Standards Applicable to Generators of Hazardous Waste"
  - c) 40 CFR 262 "Standards Applicable to Transporters of Hazardous Waste"
  - d) 40 CFR 264 "Standards for Owners and Operators of hazardous Waste Treatment, Storage and Disposal Facilities"
  - e) 40 CFR 265 "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities"
  - f) 40 CFR 268 "Land Disposal Restrictions"
  - g) 40 CFR 300 "National Oil and Hazardous Substances Pollution Contingency Plan"
  - h) 40 CFR 302 "Designation, Reportable Quantities and Notification"
- 8) Environmental Protection Agency (EPA) Publications
  - a) SW-846 Test Methods for Evaluating Solid Waste-Physical/Chemical Methods
  - b) Method 3050 "Acid Digestion of Sediments, Sludges and Soils"
- C. Texas Commission on Environmental Quality (TCEQ): Title 30 TAC 106.4, Requirements for Permitting By Rule; Title 30 TAC 106.263, Routine Maintenance, Start-up and Shutdown of Facilities and Temporary Maintenance Facilities for painting operations; Title 30 TAC 106.452, Dry Abrasive Cleaning; and Title 30 TAC 106.227 Soldering, Brazing, Welding, Title 30 TAC 335, Solid Waste Management requirements involving the storage, packaging, and disposal of solid waste including hazardous and non-hazardous waste.

## 1.04 NON-COMPLIANCE

The OWNER may issue an order stopping all or part of the Work for failure to comply with the provisions of this Section until corrective action has been taken. No time lost due to such stop orders shall be the subject of a claim for extension of time or for costs or damages unless it is later determined that the CONTRACTOR was in compliance.

## 1.05 SUBCONTRACTORS

A. The CONTRACTOR shall enforce compliance with this Section by his subcontractors.

## 1.06 MANAGEMENT OF HAZARDOUS AND NON-HAZARDOUS WASTE

A. General

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- 1) The CONTRACTOR will generate a variety of different wastes and in different forms: solids, liquids, gas, or any combination of these based upon the Scope of Work entailed. Waste is any product that is no longer needed or that is not being used for its intended purpose. Waste falls into one of the two categories known as hazardous, or non-hazardous waste as shown below. An unused material, stored for later use with approval from the Project Manager, is not waste unless it is past its shelf life or is spilled.
- 2) Depending on the types of products used by the CONTRACTOR for the Work performed under the Contract, the CONTRACTOR may create "waste" which may be regulated as a hazardous waste, or a non-hazardous waste stream. A "waste stream" is generated when a product creates a by-product or it is not going to be used as it was originally intended. Within the State of Texas, an industrial facility that creates a "waste stream" is required to determine if it is hazardous, or non-hazardous. Non-hazardous waste can be segregated into three categories which are defined as Class 1, 2 or 3 in Title 30 TAC 335, Industrial Solid Waste and Municipal Hazard Waste, Subchapter R, Waste Classification. The CONTRACTOR, prior to bidding. should evaluate their means and methods for each specific task performed under the Scope of Work to determine if they will create a "waste stream". Some typical "waste streams" that may be created from abatement and coating work include blast media, filter media, excess paint, solvent waste, and empty paint cans.

## B. CONTRACTOR'S REQUIREMENTS

- 1) The CONTRACTOR is responsible for determining the types of "waste streams" which may be produced from the Work entailed.
- 2) The CONTRACTOR is responsible for properly packaging or containerizing all "waste streams" generated from the work done on a daily basis.
- The CONTRACTOR is responsible for packaging for disposal all hazardous, class 1 waste, and scrap metal generated by acts or processes required under this scope. CONTRACTOR is responsible for the associated cost involving the transportation and disposal of any hazardous waste or class 1 non hazardous waste due to work performed under this contract. In addition CONTRACTOR is responsible for the cost of packaging, transporting, and disposal of all Class 2 and/or 3 non-hazardous wastes.
- 4) All paint containers, including containers that contained paint additives, shall be cleaned of all residues and shall be rendered non-usable by crushing or puncturing.
- 5) The CONTRACTOR is responsible for ensuring proper disposal of water, spoils and water "mixtures" and spoils generated as a result of their means and methods along with spills generated from maintenance of storm water control systems associated with CONTRACTOR activities.
- 6) The CONTRACTOR shall provide continuous cleanup work at the job site. All debris resulting from any of the direct or related Work performed by the

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CONTRACTOR shall be promptly containerized and managed in accordance with Texas Commission on Environmental Quality or Department of Health Standards. No liquid waste shall be disposed of in facility drains. On site disposal will not be permitted for any material. All costs of removing debris shall be incidental to the Work, and no separate payment will be made therefore.

- 7) Approved Vendors the CONTRACTOR must use one of the following approved vendors for hauling, per OWNER requirements:
  - a) Clawson
  - b) Arrow
  - c) Bin Dumped
  - d) Hook N Haul
  - e) Central Waste & Recycling
  - f) Central Texas Refuse (CTR)
  - g) Lossen Brothers Construction
  - h) Recon Services
  - i) Liberty Dumpster Rental
  - j) Texas Disposal Systems (TDS)

#### 1.07 CERTIFICATION

A. The interior and exterior of all bulk tanks brought onto the job site must be clean and free of any residue before being used on the Project. This is applicable for all tanks leased and/or owned. The CONTRACTOR shall provide this certification to the OWNER before use. The OWNER reserves the right to approve or reject the use of any bulk tank brought on site by the CONTRACTOR.

PART 2: PRODUCTS (Not Used)

PART 3: EXECUTION (Not Used)

PART 4: MEASUREMENT AND PAYMENT

## 4.01 GENERAL

A. No separate payment shall be made for this item.

**END OF SECTION 02105** 

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## SUBGRADE PREPARATION

# PART 1: GENERAL

#### 1.01 DESCRIPTION

A. This item shall consist of scarifying, blading and rolling the subgrade to obtain a uniform texture and provide as nearly as practicable a uniform density for the top 6 inches of the subgrade.

## 1.02 SUBMITTALS

- A. Submittals shall conform to the requirements of Section 01300, Submittals.
- B. All standard proofrollers and proposed alternate equipment must be approved by the Engineer prior to their use. The Contractor shall submit manufacturer's literature for the proofroller indicating the equipment weight, ballast capacity, tire size/ply and the contact area/contact pressure for the full range of loadings and tire inflation pressures for the particular tires furnished.

## PART 2: EQUIPMENT

## 2.01 STANDARD PROOFROLLER

- A. Proofrolling equipment shall have a body suitable for ballast loading supported on a minimum of two (2) axles with not more than two (2) pneumatic tired wheels per axle. Pneumatic proofrolling equipment with multiple pivotal axles and more than two tires along the front or rear axle axis shall have articulating axle supports to equally distribute the load to all tires over uneven surfaces.
- B. The proofroller unit shall have a minimum contact width of 7 ½ feet and shall be so designed that the gross roller weight may be varied by ballasting. The proofroller minimum gross weight shall be 25 tons. The tires shall be capable of operating under various loads with variable air pressures. The tires shall be smooth tread and shall impart a minimum ground contact pressure of 75 pounds per square inch. The proofroller shall be drawn by a power train of adequate tractive effort or may be of a self-propelled type. The proofrolling equipment shall be equipped with a reverse mode transmission or be capable of turning 180 degrees in the street width. When a separate power train is used to draw the proofroller, the power train weight shall not be considered in the weight of the proofroller. The power train shall be rubber-tired when rolling subgrade and base. A cleated or track-type power train may be used on earth and rock embankments.

## 2.02 ALTERNATE EQUIPMENT

A. With the written approval of the Engineer, the Contractor may utilize alternate equipment on embankment courses, subgrade and base courses subject to the

requirements of the standard proofroller except with respect to minimum contact width, axle/tire arrangement and tire tread.

B. Alternate equipment for stability testing of embankments shall be restricted to equipment that can be shown to impart a stress distribution on the embankment structure equivalent to or greater than the stress induced by the concentrated weight of a standard proofroller.

#### PART 3: EXECUTION

## 3.01 CONSTRUCTION METHODS

- All preparing of the right-of-way and/or clearing and grubbing shall be completed Α. before starting the subgrade preparation. The subgrade shall be scarified and shaped in conformity with the typical sections and the lines and grades indicated or as established by the Engineer by the removal of existing material or addition of approved material. All unsuitable material shall be removed and replaced with approved material. All foundations, walls or other objectionable material shall be removed to a minimum depth of 18 inches under all structures and 12 inches under areas to be vegetated. All holes, nuts and depressions shall be filled with approved material. The surface of the subgrade shall be finished to the lines and grades as established and be in conformity with the typical sections indicated. Any deviation in excess of ½ inch cross-section and in a length of 10 feet measures longitudinally shall be corrected by loosening, adding or removing material, reshaping and compacting by sprinkling and rolling. Sufficient subgrade shall be prepared in advance to insure satisfactory prosecution of the Work. Contractor will be required to set blue tops for the subgrade on centerline, at quarter points and curb lines or edge of pavement at intervals not to exceed 50 feet. Subgrade shall be tested by proofrolling in conformity with Paragraph 3.03 Proofrollng prior to placing first course of base material.
- B. All suitable material removed may be utilized in the subgrade with the approval of the Engineer. All other material required for completion of the subgrade shall also be subject to approval by the Engineer.

## 3.02 PROOFROLLING

- A. The entirety of prepared surfaces to be tested by this method shall be proofrolled by a minimum of one pass of the proofroller tires. When alternate equipment is proposed and only one axle meets minimum requirements, only the qualifying axle shall be used to proofroll. If the operation of the proofroller shows an area to be unstable, the substandard area shall be brought to satisfactory stability and uniformity by additional curing, compaction, or by removal and replacement of unsuitable materials. The re-worked area shall then be proofrolled.
- B. Proofrollers shall be operated at speeds between 2 and 6 miles per hour or as directed by the Engineer.
- C. It is the intent of this specification to provide the required density and moisture control for the subgrade based on the plasticity characteristics of the approved materials. The subgrade materials shall be sprinkled as required and compacted

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to the extent necessary to provide the density specified below, unless otherwise indicated on the Drawings. The Plasticity Index (P. I.) will be established in accordance with TxDOT Test Methods Tex-104-E, Tex-105-E and Tex-106-E. The density determination will be made in accordance with TxDOT Test Method Tex-115-E. Subgrade shall be compacted to a minimum, of 95% relative density.

- D. Subgrade materials on which planting or turf will be established shall be compacted to a minimum of 85 percent of the density as determined in accordance with TxDOT Test Method Tex-114-E. Field tests for density in accordance with TxDOT Test Method Tex-115-E will be made as soon as possible after compaction operations are completed. If the materials fail to meet the density specified, it shall be reworked as necessary to obtain the density required.
- E. Prior to placement of any base materials, the in-place density and moisture content of the top 6 inches (150 mm) of compacted subgrade shall be checked. If the tests indicate that the relative density and moisture do not meet the limits specified in the table above, the subgrade shall be reworked as necessary to obtain the specified compaction and moisture content. All testing and retesting shall be paid for by the Contractor.

## PART 4: MEASUREMENT AND PAYMENT

A. No separate payment shall be made for this item.

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## **SECTION 02210**

## FLEXIBLE BASE

## PART 1: GENERAL

#### 1.01 SCOPE OF WORK

A. This item shall consist of caliche, gravel or equivalent course for surfacing, pavement or other base courses, furnished and installed on an approved prepared surface. "Flexible Base" shall be constructed as herein specified in one or more courses in conformity with the typical sections and to the lines and grades as indicated in the Drawings or as established by the Engineer.

## 1.02 PRODUCTS

A. "Flexible Base" per TxDOT Item No. 247, Grade 2, type D or equivalent, authorized by Engineer.

## B. Asphaltic Material

1) Prime Coat: Prime Coat shall conform to the requirements of Section 02511 "Hot-Mix Asphalt Paving".

## C. Managing Material

- 1) Prior to the stockpiling of material, the area shall be cleaned of trash, weeds and grass and be relatively smooth. Stockpiles shall be constructed to be between 20,000 and 40,000 cubic yards in size. The size may be limited to the ability of the available equipment to construct, mix and test the pile. The stockpile shall be constructed utilizing equipment such as a scraper, a bottom dump or other equipment that allows spreading when dumped without rehandling. The stockpile shall be constructed to allow dump spreading in one direction only. Height of the stockpile shall not exceed the capabilities of available equipment to make a full cut (bottom to top) on any of the four (4) sides.
- 2) When the material is to be loaded from the stockpile for delivery to a Project, the material shall be loaded by making successive vertical cuts through the entire depth of the stockpile.

## 1.03 EXECUTION

## A. Preparation of subgrade

1) Flexible base shall not be placed until the Contractor has verified, by proof rolling, that the subgrade has been prepared and compacted in conformity with Section 02201, "Subgrade Preparation" to the typical sections, lines and grades indicated on the Drawings. Any deviation shall be corrected and proof rolled prior to placement of the flexible base material.

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2) After the subgrade has been successively proof-rolled, no flexible base shall be placed on the new subgrade until the new subgrade has cured to the satisfaction of the Engineer. As a minimum, this will be after the surface displays no damp spots and there is no evidence of "sponginess" in the subgrade.

## B. First Course

- Immediately before placing the flexible base material, the subgrade shall be checked as to conformity with grade and section. The thickness of each course shall be equal increments of the total base depth. No single course shall exceed six inches compacted measure.
- The material shall be delivered in approved vehicles. It shall be the responsibility of the Contractor that the required amount of specified material shall be delivered. If it becomes evident that insufficient material was placed, additional material as necessary shall be delivered and the entire course scarified, mixed and compacted.
- 3) Material deposited upon the subgrade shall be spread and shaped the same day unless otherwise approved by the Engineer. In the event inclement weather or other unforeseen circumstances render impractical spreading of the material, the material shall be spread as soon as conditions allow.
- 4) Additionally, if the material cannot be spread and worked the same day it is deposited, the dump piles shall be "closed up" before the Contractor leaves the job site for the day. The term "closed up" means using a maintainer to blade all dump piles together, leaving no open space between truck loads.
- Each course shall be sprinkled as required to bring the material to optimum moisture content and compacted to the extent necessary to provide not less than the percent density as hereinafter specified under Section 1.3.D, "Density". In no case shall the material be worked at more than 2 percent above or below optimum moisture as determined by Standard Proctor (ASTM D-698). In addition to the requirements specified for density, the full depth of flexible base material shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section of flexible base material is completed, tests as necessary will be made by the Engineer. As a minimum, three density tests per section per day will be taken. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. If any tests fail, all retesting shall be at the expense of the Contractor.
- 6) Throughout this entire operation, the shape of the material shall be maintained by blading, and the surface, upon completion, shall be smooth and in conformity with the typical section indicated on the Drawings and to the established lines and grades.
- 7) In that area on which pavement is to be placed, any deviation in excess of ½ inch in cross section and in length of 16 feet measured longitudinally shall be

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corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling. All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling. Should the course, due to any reason or cause, lose the required stability, density and/or finish before the surfacing is complete, it shall be recompacted and refinished at the sole expense of the Contractor.

# C. Succeeding Courses

- 1) Construction methods shall be the same as prescribed for the first course.
- 2) The Contractor shall set blue tops on centerline, at quarter points, at curb lines or edge of pavement, and other points that may be indicated on the Drawings; all at intervals not to exceed 50 feet; for all courses of material.

# D. Density

- 1) The flexible base shall be compacted to not less than 98 percent density and within ± 2% of optimum moisture as determined by the Standard Proctor (ASTM D-698).
- 2) Field density determination shall be made in accordance with ASTM D-2922 unless otherwise approved by the Engineer.

# E. Priming

1) After the flexible base material has been compacted to not less than 100 percent density, and tested by proofrolling, a prime coat will be applied in accordance with Section 02511.

## F. Curing

1) When a cut-back asphalt is used as a prime coat, the flexible base shall be primed and cured to the satisfaction of the Engineer but in no case shall the curing period be less than 24 hours before any paving mixture may be plaed. However, the surface on which a tack coat and/or paving mixture is to be placed shall be in a dry condition.

PART 2: (NOT USED)

PART 3: (NOT USED)

## PART 4: MEASUREMENT AND PAYMENT

- A. "Flexible Base" will be measured by the cubic yard, complete in place.
- B. The unit bid price shall include full compensation for all work specified herein, including the furnishing, hauling, placing and compacting of all materials; for rolling, proof rolling, recompacting and refinishing; for all water required; for

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retesting as necessary; for priming; and for all equipment, tools, labor and incidentals necessary to complete the Work. Prime coat will not be measured nor paid for directly

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## HOT-MIX ASPHALT PAVING

## PART 1: GENERAL

## 1.01 SCOPE OF WORK

- A. Submittals: Product Data, material certificates, and the following:
  - 1) Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

# Job-Mix Designs: For each job mix proposed for the work

- B. Installer Qualifications: Engage an experienced installer who has completed hotmix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- C. Manufacturer Qualifications: Manufacturer of hot-mix asphalt shall be a registered and approved paving mix manufacturer with authorities having jurisdiction or with TxDOT.
- D. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.
- E. Asphalt-Paving Publication: Comply with Al's "The Asphalt Handbook", except where more stringent requirements are indicated.
- F. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:
  - 1) Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
  - 2) Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
  - 3) Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.
- G. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

## PART 2: PRODUCTS

- A. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D242.
- B. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.
- C. Prime Coat: ASTM D 2027; medium-curing cutback asphalt; MC-30, MC-70, or MC-250.
- D. Prime Coat: Asphalt emulsion prime conforming to TxDOT requirements.
- E. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

- F. Herbicide: Use of herbicide shall not be allowed.
- G. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in Al's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
  - 1) Base Course: As specified in Section 02210, Flexible Base.
  - 2) Surface Course: Type D Asphalt conforming to the following gradation:

Sieve Size	% Passing
1/,"	100
3/8"	85-100
No. 4	50-70
No. 10	32-42
No. 40	11-26
No. 80	4-14
No. 200	1-6

H. "Model Construction Specifications for Asphaltic Concrete and other Plant Mix Types" (SS-1) by the Asphalt Institute indicates that the following requirements be satisfied for the bituminous surface course based on Marshall Method:

Compaction (No. of Blows/Side)	50
Minimum Stability (Lbs)	750
Flow Range (1/100 inches)	8-18
Percent Air Void Range	3-5%
Minimum Voids in Mineral Aggregate (VMA)	15%

## PART 3: EXECUTION

- A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas are unstable or that require further compaction.
  - 1) Before placing asphalt materials, remove loose and deleterious material from substrate surfaces.
- B. Herbicide Treatment: Use of herbicide shall not be allowed.
- C. Prime Coat: Apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 72 hours minimum.

- D. Tack Coat: Apply uniformly to existing surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq.yd. (0.2 to 0.7 L/sq. m) of surface. Allow tack coat to cure undisturbed before paving.
  - 1) Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- E. Machine place base and surface courses of hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.
- F. Promptly correct surface irregularities in paving course behind paver. Remove excess material and fill depressions with hot-mix asphalt.
- G. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
- H. Compact paving as soon as placed hot-mix asphalt will bear roller weight. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
  - 1) Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- I. The bituminous surface course should be compacted to within at least 96% Marshall Density as determined by Standard Proctor (ASTM D-698).
- J. Compact each hot-mix asphalt course to the following tolerances:
  - 1) Thickness: Base course, plus or minus ½ inch (13mm); surface course, plus ½" inch (6mm), no minus.
  - 2) Surface Smoothness: Base course, ¼ inch (6mm); surface course, 1/8 inch (3mm).
- K. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt compacted by rolling to specified density and surface smoothness.

## PART 4: MEASUREMENT AND PAYMENT

- A. Asphaltic concrete pavement shall be measured by the square yard of specified total thickness of the type of paving mixture actually used in completed and accepted Work in accordance with Drawings and specifications. Multiple lifts of the same type shall be considered as one for square yard measurement purposes.
- B. Payment shall be made by: Type D Hot Mix Asphaltic Concrete Pavement Complete and in Place, 1.5 Inches, per Square Yard

# STRUCTURAL EXCAVATION, BACKFILL AND COMPACTION

## PART 1: GENERAL

#### 1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and related items required to remove all earth, rock, water and other materials to the extent required for the construction of the facilities shown on the Drawings; to prepare the subgrade or subbase for the foundation of the facilities; and backfill around the facilities to the lines and grades established on the Plans. All operations required for the proper completion of the excavation work, including sheet piling, shoring, bracing, dewatering of excavations, compaction of backfill and disposal of excavated material are included.
- B. Unless noted otherwise, the following are included in the Scope of Work:
  - 1) The removing of all surface obstructions.
  - 2) The making of all necessary excavations.
  - 3) The providing of all necessary clearing.
  - 4) The furnishing and installing of all sheet piling, shoring, and bracing as necessary or directed.
  - 5) The pumping and bailing to keep trenches free of water during pipe laying and jointing, and thereafter until each joint, mortar, or concrete is set.
  - 6) The providing for uninterrupted surface water flow during work progress.
  - 7) The providing for and disposing of flows from sewers, storm drains, creeks, or other sources.
  - 8) The protecting of all pipes, conduits, culverts, tracks, utility poles, wires, fences, buildings, and other public and private property adjacent to or in the line of work.
  - 9) The removing of all sheet piling, shoring, and bracing not ordered or required to be left in place.
  - 10) The hauling away and disposing of excavated materials not necessary or else unsuitable for backfilling purposes.
  - 11) Backfilling.

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## 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Subsurface Investigation: Section 02010.
- B. Trench Safety Systems: Section 02227.
- C. Dewatering and Drainage of Excavation: Section 02530.
- D. Concrete for Utility Construction: Section 03305.

## 1.03 REFERENCE STANDARDS

- Unless otherwise stated, the latest edition of specifications of the American Α. Society for Testing and Materials (ASTM) listed below shall apply to this Section to the extent applicable in each reference:
  - 1) ASTM D 424 Test for Plastic Limit and Plasticity Index of Soils.
  - 2) ASTM D 448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
  - 3) ASTM D 698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>[600 kN-m/m<sup>3</sup>]).
  - 4) **ASTM D 1556** Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
  - **ASTM D 1557** Test Method for Laboratory Compaction Characteristics of 5) Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>[2,700 kN-m/m<sup>3</sup>]).
  - **ASTM D 2167** Standard Test Method for Density and Unit Weight of Soil 6) in Place by the Rubber Balloon Method.
  - **ASTM D 2487** Standard Test Method for Classification of Soils for 7) Engineering Purposes.
  - Standard Test Methods for Density of Soil and Soil-8) ASTM D 2922 Aggregate in Place by Nuclear Methods (Shallow Depth).
  - Standard Test Method for Density of Soil in Place by the 9) ASTM D 2937 Drive-Cylinder Method.
  - 10) ASTM D 2940 Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
  - 11) ASTM D 3017 Standard Test Methods for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

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- 12) ASTM D 3740 Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction.
- 13) ASTM D 4254 Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- 14) ASTM D 4491 Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- 15) ASTM D 4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- 16) ASTM D 4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile.

## 1.04 SUBMITTALS

- A. Submittals shall comply with the requirements in Section 01300.
- B. The CONTRACTOR shall submit the following for review by the ENGINEER.
  - Submit calculations and drawings showing the design and details of proposed sheet piling, shoring and bracing, and the proposed sequence of excavation and backfill. The calculations shall be sealed by a registered professional engineer licensed in the state of Texas. Review of the calculations and drawings by the ENGINEER is for acceptance only insofar as it affects the completed work, and such acceptance will not relieve the CONTRACTOR of the responsibility for the adequacy of the design.
  - 2) Submit evidence of successful completion of projects of comparable size and complexity, including the qualifications of its field superintendent and design engineer.
  - 3) Evidence of bodily injury and property damage liability insurance shall be submitted by the CONTRACTOR or SUBCONTRACTOR installing the sheet piling.
  - 4) Submit testing laboratory reports to show compliance with specifications for all materials from off-site locations. The specified tests shall be performed by a certified independent testing laboratory employed and paid by the CONTRACTOR.
  - 5) Submit details of all proposed dewatering systems. Review and acceptance by the ENGINEER will not relieve the CONTRACTOR of any responsibility for the adequacy of the dewatering system.

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## 1.05 PROTECTION OF EXISTING FACILITIES AND ENVIRONMENT

- A. Before the start of earthwork operations, adequately protect existing structures, utilities, trees, shrubs and other permanent objects from damage. CONTRACTOR shall be responsible for the repairs or replacement of any and all existing structures, pipes, facilities, trees, shrubs, etc. which are damaged or destroyed by his operations, all at no additional cost to the OWNER.
- B. Environmental Safeguards and Regulations. The CONTRACTOR shall comply with all Local, State, and Federal regulations to prevent pollution of air and water.
- C. The CONTRACTOR shall conduct his operations in such fashion that trucks and other vehicles do not create a dirt nuisance in the streets. The truck beds shall be sufficiently tight, and shall be loaded in such a manner that objectionable materials will not be spilled onto the streets. Any dirt, mud, or other materials that are spilled onto the streets or deposited onto the streets by the tires of vehicles shall be promptly cleared away by the CONTRACTOR.

#### 1.06 BLASTING

A. Blasting will not be permitted.

## 1.07 INSPECTION OF EXCAVATIONS

A. Notify the ENGINEER at least 48 hours prior to completion of any excavation so that the ENGINEER may inspect the excavation. Do not place reinforcing steel or concrete in the excavation prior to inspection unless the ENGINEER has given approval to proceed without inspection.

## PART 2: PRODUCTS

#### 2.01 MATERIALS

- A. Clean gravel or pea gravel conforming to the requirements of Section 02225 shall be used to backfill excavations for yaults and manholes.
- B. Regular Material. Where no other material is specified or shown, use suitable soils from the excavation. Do not use rocks, boulders, peat or other organic matter, silt, muck, debris or similar materials.
- C. Backfill of below grade structures and grinder pump units shall be a material that classifies as CL, SC, or SP material. CL and SC materials shall have a PI between 5 and 20, a maximum particle size of 3 inches, and be free of organics and/or deleterious material.
- D. Pre-construction testing of materials to certify conformance with the specification requirements shall be performed by a testing laboratory selected and paid by the CONTRACTOR. CONTRACTOR's testing agency shall perform tests upon change of source and at sufficient intervals to certify conformance of all select material furnished for use on this project.

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# PART 3: EXECUTION

## 3.01 EXCAVATION

#### A. General

- 1) Excavations shall be of such dimensions as to permit the construction of the work in the manner, shape and size shown on the Plans.
- 2) Excavation and backfill work shall meet the requirements of the geotechnical report as referenced in Section 02010, Subsurface Investigation.

## B. Authorized Additional Excavation

1) Where the existing subgrade material on which the foundation, footing or slab is to be placed is deemed unsatisfactory by the ENGINEER, carry the excavation to an additional depth specified by the ENGINEER and fill the excavated space with an approved material. The additional excavation and select base material shall be paid for as specified in Part 4.

# C. Approved Additional Excavation

Upon written request by the CONTRACTOR, the ENGINEER may approve additional excavation. Carry the excavation to a depth approved by the ENGINEER, and fill the excavated space below the structure foundation with an approved material. Such work shall be considered as a convenience to the CONTRACTOR and shall be done at no additional cost to the OWNER.

## D. Unauthorized Excavation

1) Whenever the excavation is carried beyond or below the lines or grades shown on the Drawings, refill all such excavated space below the structure foundation with 2,000 psi concrete. This work shall be done at no additional cost to the OWNER.

# E. Material Storage

1) Stockpile excavated materials classified as satisfactory soil material where directed by the OWNER until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

# F. Shoring, Sheet Piling and Bracing

Excavations shall be properly shored, sheet piled and braced as the nature of the ground may require and as indicated on the Plans, to prevent shifting of material with possible damage to existing or uncompleted structures and attendant delay of work. The design of sheet piling, shoring, and bracing shall be the responsibility of the CONTRACTOR.

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## G. Structures

- Wherever practicable, cut all footing excavations to neat lines with a tolerance of minus 1 inch or plus 3 inches, and place concrete to bear against earth sides. Excavate at sufficient distance from walls, shafts or similar elements of structures to allow for placing and removing forms and for inspection.
- 2) Excavate to the elevations shown on the drawings forming a level undisturbed surface free of mud or other soft material. When the bottom of the excavation, at the elevation shown, is unsuitable for foundation bearing, notify the ENGINEER. Excavate to deeper levels, as directed by the ENGINEER. Remove all pockets of soft or otherwise unstable soils and replace with concrete or with suitable well-compacted soil as directed by the ENGINEER.
- 3) Protect all open excavations from rainfall or excessive drying so as to maintain the foundation subgrade in a satisfactory, undisturbed condition. Keep excavations free of water (accumulations exceeding one (1) inch) at all times. Soils below foundation, which become soft, loose or otherwise unsatisfactory for support of the foundation as a result of inadequate excavation, dewatering or other construction methods shall be removed and replaced with satisfactory material, as directed by the ENGINEER, at no additional cost to the OWNER.
- 4) All excavations should be protected so as not to affect water content of subgrade prior to placement of foundation.

## 3.02 DEWATERING OF EXCAVATION FOR STRUCTURES

A. All excavations shall be kept dewatered in accordance with Section 02530.

#### 3.03 VAPOR BARRIER MEMBRANE

- A. As soon as practical after final grading, while the base material is still at its optimum moisture content, install a vapor barrier membrane over the prepared surface at locations shown on the drawings.
- B. Lay the membrane material continuous with the joints, lapped 6 inches in the direction of the concrete placement. Carefully fit the membrane tight around all penetrations.
- C. Before placing concrete, patch all holes and tears in membrane with patches cemented in place with adhesive. Seal around penetrations for conduit, piping, etc., with cold mastic.
- D. A vapor barrier membrane shall also be provided above the roof before backfilling operations.

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# 3.04 BACKFILLING

- Α. Placement of Backfill – Below Grade Structures
  - 1) Fill material in accordance with Section 2 shall be placed and compacted to a minimum compaction of 95% of the maximum dry density as determined using TxDOT Test Method TEX-114-E. Compacted lift thicknesses shall be 6-inches or less and water content shall be within plus or minus 2% of optimum.

### 3.05 EXISTING UTILITIES

- Α. Locate existing underground utilities in the areas of work. Provide adequate means of protection during excavation operations.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the utility owner immediately for directions. Cooperate with the owner and public and private utility companies in keeping their respective services and facilities in operation. Immediately repair damaged utilities to the satisfaction of the utility owner.
- C. Do not interrupt existing utilities serving facilities occupied and used by the owner of others, except when permitted in writing by the OWNER, and then only after acceptable temporary utility services have been provided.

# 3.06 DISPOSAL OF EXCESS MATERIAL

Α. Excess excavation material or material unsuitable for select backfill in site grading shall be disposed of at a site licensed to receive such materials or at a site approved by the OWNER.

#### PART 4: MEASUREMENT AND PAYMENT

Α. No separate payment shall be made for this item.

END OF SECTION 02220

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# TRENCHING, BACKFILLING, EMBEDMENT AND ENCASEMENT

### PART 1: GENERAL

#### 1.01 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, equipment, and materials, in connection with the excavation, trenching, backfill, embedment and concrete encasement required to install the underground pipelines shown on the Drawings, and as specified.
- B. Excavation shall include the removal of any trees, stumps, brush, debris, or other obstacles that may obstruct the line of work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings, or as specified.
- C. Backfill shall include the refilling and consolidation of the fill in the trenches and excavations up to the surrounding ground surface or grade indicated on Drawings.

# 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Trench safety systems: Section 02227
- B. Concrete for Utility Construction: Section 03305

# 1.03 QUALITY ASSURANCE

- A. Excavation for pipe construction shall be in accordance with this specification.
- B. Density. Determination of the density of backfill in-place shall be in accordance with the requirements of TxDOT Test Method TEX-114-E for clayey soils and TEX-113-E for gravelly soils.
- C. Sources and Evaluation Testing. Pre-construction testing of materials to certify conformance with the specification requirements shall be performed by a testing laboratory selected and paid by the CONTRACTOR. CONTRACTOR's testing agency shall perform tests upon change of source and at sufficient intervals to certify conformance of all select material furnished for use on this project.

# 1.04 EXCAVATION SAFETY

A. All trench excavation and backfill operations shall be in accordance with the latest OSHA excavation safety standards OSHA 2226 and 29 CFR Part 1926 Subpart P. The CONTRACTOR shall provide a trench excavation plan prepared by an Engineer licensed in the State of Texas. The trench excavation plan shall indicate the procedures to be used by the CONTRACTOR to comply with OSHA

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requirements. The trench excavation plan shall identify the "Competent Person" as required by paragraph 1926.651(k)(1) that will work with each crew.

B. The ENGINEER or OWNER reserves the right to deny payment for any construction activities in excavations or trenches which are not in accordance with the trench excavation plan.

#### 1.05 SUBMITTALS

- A. Submittals shall be in accordance with Division 1 of the Specifications and shall include the following:
  - 1) Trench excavation plan designed in accordance with the latest OSHA excavation safety standards OSHA 2226 and 29 CFR Part 1926. The trench excavation plan shall be submitted prior to starting any excavation work.
  - 2) Materials for embedment and backfill of pipe including laboratory test reports as required.

# PART 2: PRODUCTS

### 2.01 CONCRETE

A. Concrete for embedment, encasement, trench caps, retards, and thrust blocking shall conform to specification Section 03305, Class B Concrete. Dry mix will not be permitted.

### 2.02 FLOWABLE FILL

- A. Flowable fill, or Controlled Low Strength Material (CLSM), may be used as trench backfill as approved by the OWNER's Representative.
  - 1) Portland cement shall be ASTM C 150, Type I.
  - 2) Fly ash shall meet the requirements of TxDOT Specification Item 437.
  - 3) Filler aggregate shall consist of sand, stone screenings, pavement milling cuttings or other granular material that is compatible with the other mixture components. The filler aggregate shall be fine enough to stay in suspension to the extent required for proper flow without segregation, and, in the case of filling of enclosures, for minimal settlement. Filler aggregate shall have a Plasticity Index (TxDOT Test Method Tex-106-E) less than 15 and shall have a maximum of 10% passing a No. 200 sieve.
  - 4) An air entraining admixture with a higher than usual dosage shall be used as a settlement compensator. The settlement compensator may be introduced to the CLSM at the job site by placement of prepackaged admixture in capsules or bags in the mixing drum in accordance with the admixture manufacturer's recommendations.

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- 5) The mix design shall be prepared by a qualified commercial laboratory and then reviewed and signed by a registered Professional Engineer licensed in the State of Texas.
- The flowable fill mix design shall achieve an unconfined compressive strength of 35 psi within 24 hours and 300 psi within 28 days. The compression tests shall be conducted in accordance with TxDOT Method Tex-418-A, using approved unbonded caps on specimens with four-inch (100 mm) diameter and eight-inch (200 mm) height [or three-inch (75 mm) diameter by six-inch (150 mm) high specimens if a smaller capacity loading device gives more accurate results].
- 7) Ball Drop tests shall be used to determine, when the CLSM has developed sufficient strength to be covered or subjected to traffic or other loads as approved by the OWNER's Representative. The Ball Drop test shall be performed according to the latest version of ASTM C-360. An indentation diameter of three inches (75 mm) or less, and the absence of a sheen or any visible surface water in the indentation area shall indicate that the CLSM has achieved the desired strength. Because trench width and depth may affect the test results, the Contractor may perform this test on a control sample of CLSM in a two-foot (600 mm) square by six-inch (150 mm) deep container.

# 2.03 PIPE EMBEDMENT

- A. Pipe embedment shall consist of the bedding envelope to the full width of the trench to the height shown on the Drawings. The materials to be used for the bedding envelope for pressurized ductile iron water pipelines shall be either pea gravel or uncrushed pipe bedding stone in accordance with the following:
  - 1) Pea gravel bedding shall be clean washed material, hard and insoluble in water, free of mud, clay, silt, vegetation or other debris. Stone quality shall meet ASTM C 33. Size gradation shall be as follows:

SIEVE SIZE	% RETAINED BY WEIGHT	
3/4"	0	
1/2"	0-25	
1/4"	90-100	

2) Pipe bedding stone shall be free of mud, clay, vegetation or other debris, conforming to ASTM C 33 for stone quality. Size gradation shall conform to ASTM C-33 No. 57 or No. 67 or the following Table:

SIEVE SIZE	% RETAINED BY WEIGHT	
1-1/2"	0	
1"	0-10	
1/2"	40-85	
#4	90-100	
#8	95-100	

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### 2.04 BACKFILL MATERIAL

- A. Unless otherwise specified or required elsewhere, the backfill shall be material from the trench excavation, except the top 6-inches in unpaved areas shall be the topsoil which shall be placed separately. See Drawings for details.
- B. No material of a perishable, spongy or otherwise unsuitable nature, or rock greater than 3 inch diameter, shall be used in backfilling.

### PART 3: EXECUTION

### 3.01 TRENCH EXCAVATION

A. Topsoil. Topsoil and grass shall be stripped a minimum of 6-inches over the excavation site and stockpiled separately for replacement over the finished grading areas.

#### B. Excavation.

- 1) Trenches shall be excavated to the lines and grades shown on the Drawings. Trench depths shall allow for the placement of pipe bedding as shown on the Drawings.
- 2) Should the bottom of the trench become an unstable foundation for the pipe through the failure of the CONTRACTOR to adequately perform, the CONTRACTOR shall remove the unstable material and fill the trench to the proper subgrade with granular embedment material. No extra compensation will be allowed for this material or work.
- 3) Should the undisturbed material encountered at the grade depth constitute, in the opinion of the OWNER, an unstable foundation for the pipe, the CONTRACTOR shall be required to remove such unstable material and fill the trench to the proper subgrade with granular embedment material.

### 3.02 TRENCH SAFETY

- A. Excavation shall conform to the requirements of the Occupational Safety and Health Act.
- B. Excavation shall conform to the requirements of section 02227: Trench Safety Systems.
- C. All excavations for the installation of underground piping shall be accomplished in accordance with Section 02220, Structural Excavation, Backfill and Compaction.
- D. Should the CONTRACTOR elect to utilize sheeting, shoring or trench boxes for installation of the underground piping, the following additional requirements apply:

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- 1) Sheeting, shoring or trench box shall be withdrawn at the same rate the pipe embedment and backfill is placed and compacted. Any voids shall be filled with pipe embedment materials and compacted.
- 2) Sheeting may be left in place at no additional cost to the OWNER, if approved by the ENGINEER.

#### 3.03 EXCAVATED MATERIALS

A. Excavated material shall be placed adjacent to the work to be used for backfilling as required. The placement of excavated material adjacent to the work shall be in accordance with OSHA. Top soil shall be placed separately in a careful manner and replaced in its original position.

# 3.04 PIPE EMBEDMENT

- A. The initial layer of embedment placed to receive the pipe shall be brought to grade and dimensions indicated on the Drawings, and the pipe shall be placed thereon and brought to grade by tamping, or by removal of the slight excess amount of embedment under the pipe. Adjustment to grade line shall be made by scraping away or filling with embedment material. Wedging or blocking up of pipe will not be permitted. Each pipe section shall have a uniform bearing on the embedment for the length of the pipe, except immediately at the joint for non-HDPE pipe material. All embedment and/or encasement shall extend the full width of the trench bottom.
- B. The remainder of embedment shall be placed to the depth shown on the Drawings. The embedment material shall be brought up in hand or mechanically tamped layers not exceeding 12 inches in thickness of loose fill approximately equal on each side of the pipe. Each lift of embedment shall be compacted to a minimum of 95% Standard Proctor Density.
- C. Final backfilling shall be as specified in this section.
- D. If flowable backfill is to be utilized it shall be placed as shown on the Plans. Flowable backfill shall be placed continuously for the full trenching envelope.

#### 3.05 CONCRETE EMBEDMENT AND ENCASEMENT

- A. After pipe joints are completed, the voids at the joints in the embedments shall be brought to proper grade. Where concrete is placed over or along the pipe, it shall be placed in such manner as not to injure the joints or displace the pipe.
- B. While placing concrete embedment and until the concrete sets up, each pipe shall be properly braced and held to grade so as to prevent any possible shifting or floating of the pipe.
- C. No cleavage line between the base concrete and the side or top concrete will be allowed. Backfilling shall be done in a careful manner and at such time after concrete embedment or encasement has been placed as not to damage the concrete in any way.

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D. Backfill placed over concrete embedment, encasement, cradle, or block shall not be placed until the concrete has set up to such an extent that backfill operations will not damage the concrete.

#### 3.06 FINAL BACKFILL PLACEMENT

- A. From 12 inches above the top of the pipe, or as shown on the Drawings, the trench or excavation shall be backfilled with select material from the excavation placed in a manner approved by the OWNER. No excessively large rocks or debris of any sort are to be put into the backfill, and appreciable weight of any sort, other than backfill, shall not be allowed on the pipe until it has been covered to such a depth that damage to the pipe or joints will not occur. The top 6 inches shall be free from rock.
- B. Excavated material which is unsuitable for backfilling and excess material shall be disposed of in a manner approved by the OWNER. The OWNER may require surplus material to be hauled to a designated waste area in other areas.
- C. Method of Consolidation.
  - The CONTRACTOR shall provide an acceptable method for consolidation of material 12 inches or more above the pipe. This material may be placed mechanically or by other means to provide the compaction required and indicated on the Drawings. Such material shall be tested and approved by the ENGINEER before continuing. The initial test section shall be a minimum of 100 lineal feet. Material not meeting required specification shall be removed and replaced at no additional cost to the OWNER.
  - 2) Backfill Under Road, Concrete Slabs, and Related Items. The backfill for trenches under roads, concrete slabs, and related items shall be well graded sand, free from binders, rocks, lumps, organic or clay material, except where concrete backfill is shown on the Drawings. The backfill shall be consolidated to provide a density of compaction of at least 95 percent of the maximum dry density tested in accordance with this Section.
  - 3) Backfill in areas outside of paving, slabs and related items shall be consolidated to provide a density of compaction of at least 85 percent of the maximum dry density.
  - 4) Backfill in Structural Excavation Zone. The backfill for pipeline trenches located in the zone of excavation for structures shall be in accordance with Section 02220, Structural Excavation, Backfill and Compaction.
- D. When flowable fill is used as backfill, the free fall placement of the material may not exceed 4 feet. No vibration of the material will be allowed and no curing is required. Backfill or traffic may not be placed on the material until it has been tested for strength.

# 3.07 TESTING

A. Tests will be performed on a minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics in accordance with TEX-101-E. Additional classification

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tests will be performed whenever there is a noticeable change in material gradation or plasticity.

- B. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with TEX-114-E and TEX-113-E. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.
- C. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to TxDOT Test Method TEX-115-E.
  - 1) A minimum of 1 test for every 200 linear feet of pipe installed.
  - 2) Density tests will be distributed among the placement areas.
  - 3) The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density.
  - 4) Density tests may be performed at various depths below the fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.
  - 5) Two verification tests will be performed adjacent to in-place tests showing density less than the acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.
  - 6) Recompacted placement will be retested at the same frequency as the first test series, including verification tests.
- D. Recondition, recompact, and retest at CONTRACTOR's expense if tests indicate work does not meet specified compaction requirement. OWNER may choose to subtract costs from monthly payments.
- E. Acceptability of gravel compaction will be determined by inspection.

# PART 4: MEASUREMENT AND PAYMENT

A. No separate payment shall be made for this item.

**END OF SECTION 02225** 

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### TRENCH SAFETY SYSTEMS

PART 1: GENERAL

### 1.01 DESCRIPTION

A. This item consists of designing, furnishing, installing, dewatering, maintaining and removing safety systems for trench excavations as determined by Contractor's Trench Safety Engineer and/or Contractor's Competent Person(s). This includes special clearing, excavation and backfilling for safety systems. At a minimum, this work shall conform to United States Department of Labor Rules 29 CFR, Part 1926 (OSHA).

# 1.02 TRENCH SAFETY SYSTEM PLAN SUBMITTAL

A. Prior to, or at the Pre-Construction Conference, the Contractor shall submit to Owner a Trench Safety System Plan sealed by a Professional Engineer registered in the State of Texas. Notice to Proceed with construction will not be issued by Owner until Contractor has submitted a Trench Safety System Plan to Owner. The Trench Safety System Plan at a minimum, shall conform to OSHA standards for sloping of sides, utilization of trench boxes, and/or utilization of shoring, sheeting and bracing methods. Contractor shall be responsible for obtaining the necessary geotechnical information to design the Trench Safety System Plan.

The Trench Safety System Plan submittal shall include:

- A plan or other designation of areas in which each type of system is to be used, including length of trench to be opened, length of time trench to remain opened, means of egress, storage of materials, allowable loads on trench walls, methods for filling/compacting bedding/backfill within the safety of the system, removal of system and equipment restrictions.
- 2) Drawings or manufacturer's data describing various elements of Trench Safety System with sufficient detail for workers to properly install Trench Safety System, as applicable.
- 3) Recommendations and limitations for using systems.
- 4) Sealed engineering calculations and/or equipment manufacturer's certifications, as applicable, showing that system is designed to withstand anticipated loadings and can be fully installed in designated space within the street right of way or easement provided by Owner.
- 5) Certificate of Insurance of Trench Safety Engineer's Professional Liability Insurance coverage written by a company acceptable to Owner and authorized to do business in State of Texas at time policy is issued. Contractor's Trench Safety Engineer shall carry and maintain coverage with minimum limits of \$500,000.

### 1.03 TRENCH SAFETY SYSTEM PLAN SUBMITTAL

A. Review of the Trench Safety System Plan by Owner is only for general conformance to OSHA standards and regulations. Owner's failure to note exception(s) to the submittal does not relieve Contractor of any or all responsibility or liability for the Trench Safety System Plan. Contractor remains solely and completely responsible for all trench safety systems and for the means, methods, procedures, and materials therefore.

### 1.04 CONSTRUCTION METHODS

- A. Contractor's Competent Person(s) shall maintain a copy of and implement OSHA trenching safety regulations at the worksite. Trenching shall be completed to lines and grades indicated or as specified in various technical specification items requiring excavation and trenching and/or backfilling. Contractor shall perform all trenching in a safe manner and maintain safety systems to prevent death or injury to personnel or damage to structures, utilities or property in or near excavation.
- B. If evidence of possible cave-ins or slides is apparent or an installed trench safety system is damaged, work in trench shall immediately cease and personnel evacuated from hazardous area and Owner notified. Personnel shall not re-enter excavation until necessary repairs or replacements are completed, inspected and approved by Contractor's Competent person(s) Repair and replacement of damaged safety system shall be at Contractor's sole expense.

# 1.05 CHANGED CONDITIONS

- A. When changed conditions require modifications to the Trench Safety System, Contractor shall provide a new design or an alternate Trench Safety System designed by Contractor's Trench Safety Engineer adequate for conditions encountered. Copies thereof shall be provided to Owner in accordance with 1.02 "Trench Safety Plan Submittal". A copy of the most current Trench Safety System shall be maintained on site and made available to inspection and enforcement officials at all times.
- B. Changes to the Trench Safety System Plan initiated by Contractor for operational efficiency or by changed conditions that could be reasonably anticipated will not be cause for contract time extension or cost adjustment thereof. When changes to the Trench Safety System Plan are the result of severe and uncharacteristic natural conditions or other conditions totally out of the control of Contractor, Contractor may make a written request to Owner for a Change Order to address said work. Contractor shall notify Owner in writing immediately, but no later than 24 hours, whenever changed conditions are encountered that Contractor may claim for additional compensation. Only that work that Contractor deems immediately necessary to protect the safety of workers and public, equipment or materials may be accomplished until Contractor makes the written request for a Change Order and Owner has a reasonable opportunity to investigate and respond in writing to the request.

PART 2: NOT USED

PART 3: NOT USED

# PART 4: MEASUREMENT AND PAYMENT

A. Trench Safety Systems shall be measured by linear foot of water mains installed along the centerline of trench conforming to plans and specifications to cover all work on the project. No separate payment for trench safety related to fire hydrant leads or other appurtenances will be made.

END OF SECTION 02227

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SECTION 02230 EXCAVATION

### **SECTION 02230**

### **EXCAVATION**

PART 1: GENERAL

The following specifications from the 2014 Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges as currently amended shall govern construction of excavated areas.

Item 110. Excavation

### PART 2: CONTRACTOR RESPONSIBILITIES

- A. Execute all work as defined in the plans and specifications.
- B. Arrange for the securing of any necessary permits not obtained by the OWNER and pay for the same.
- C. Materials removed (including salvageable materials) are the property of the Contractor. Dispose of removed material off the right-of-way in accordance with federal, state, and local regulations.

PART 3: (NOT USED)

PART 4: MEASUREMENT AND PAYMENT

A. No separate payment shall be made for this item.

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SECTION 02231 EMBANKMENT

### SECTION 02231

#### **EMBANKMENT**

PART 1: GENERAL

The following specifications from the 2014 Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges as currently amended shall govern construction of embankments.

Item 132. Embankment

# PART 2: CONTRACTOR RESPONSIBILITIES

- A. Execute all work as defined in the plans and specifications.
- B. Arrange for the securing of any necessary permits not obtained by the OWNER and pay for the same.
- C. Materials removed (including salvageable materials) are the property of the Contractor. Dispose of removed material off the right-of-way in accordance with federal, state, and local regulations.

PART 3: (NOT USED)

### PART 4: MEASUREMENT AND PAYMENT

A. Work performed and materials furnished for Embankment shall be paid by cubic yard for at the unit price bid for the site grading as shown on the plans. This price is full compensation for authorized excavation, drying, undercutting subgrade and reworking or replacing the undercut material in rock cuts, site regrading, hauling, disposal of material not used elsewhere on the project, scarification and compaction, and equipment, labor materials, tools, and incidentals. This item applies to site grading and pond grading associated with the project. It does not apply to excavations related to elevated storage tank foundations, underground pipeline construction, etc. which are covered in their associated bid items.

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### SITE RESTORATION

# PART 1: DESCRIPTION

### 1.01 SCOPE OF WORK

- A. The work under this Section of the Specifications consists of furnishing all supervision, labor, equipment, material to repair/replace pavement, curb and gutter, driveways, install grass for ground cover, restoration of patios, walkways, rock walls and permanent erosion control of the jobsite.
- B. Revegetation shall be a continual process during the construction and will immediately follow completion of construction and testing of each section in conformance with the Section 01014 Protection of the Environment.

#### 1.02 SUBMITTALS

A. The work under this Section of the Specifications shall be performed by or under the direct on-site supervision of an individual with proven expertise with the procedures and techniques required by these specifications. The name and qualifications of that person shall be submitted to the ENGINEER for approval in conformance with Section 01300 - Submittals.

### PART 2: PRODUCTS

# 2.01 SEED MIX - ROADWAYS

A. Shall meet the requirements of the General Construction Notes on the plans.

# 2.02 SEED MIX - NATIVE GRASS

A. Revegetation of natural areas shall be accomplished using the following mixture of grasses at the indicated rates of application:

Indaingrass	0.15 lbs/1000 sq ft
Sideoats grama	0.2 lbs/1000 sq ft
Green sprangletop	0.15 lbs/1000 sq ft
Buffalo Grass	0.25 lbs/1000 sq ft
Little Bluestem	0.2 lbs/1000 sq ft
Canada Wild Rye	0.2 lbs/1000 sq ft
Eastern gamagrass	0.25 lbs/1000 sq ft
Purple Three-Awn	0.15 lbs/1000 sq ft
Switchgrass	0.1 lbs/1000 sq ft
Bushy Bluestem	0.1 lbs/1000 sq ft
Big Bluestem	0.1 lbs/1000 sq ft
Blue Grama Grass	0.15 lbs/1000 sq ft

Total Seeding Rate 2.0 lbs/1000 sq ft

### 2.03 SOIL RETENTION BLANKETS

- A. All soil retention blankets must be listed on TxDOT Approved Products List or approved by the Engineer or designated representative.
- B. The soil retention blanket shall be one (1) of the following classes and types as shown on the Drawings:
  - 1) Class 1. Slope Protection
    - a) Type A Slopes 3:1 or flatter Clay soils
    - b) Type B Slopes 3:1 or flatter Sandy soils
    - c) Type C Slopes steeper than 3:1 Clay soils
    - d) Type D Slopes steeper than 3:1 Sandy soils
  - 2) Class 2. Flexible Channel Liner
    - a) Type E Short-term duration (Up to 2 years) Shear Stress (td) < 2.0 pound per square foot [psf]
    - b) Type F Short-term duration (Up to 2 years) Shear Stress (td) ≤ 4.0 psf
    - c) Type G Long-term duration (Longer than 2 years) Shear Stress (td) ≤ 6.0 psF
    - d) Type H Long-term duration (Longer than 2 years) Shear Stress (td) ≤ 8.0 ps

### PART 3: EXECUTION

# 3.01 GROUND PREPARATION AND RESTORATION METHOD

- A. Immediately following completion of construction and in accordance with Section 01014 Protection of the Environment, excess spoil and debris shall be removed and the construction area shall be graded to the original or specified contours as shown on construction plans. The surface of the ground should be smooth with no rocks larger than 1", stumps, or other debris. Topsoil of sandy loam, loam or clay loam and free of tree roots, rocks greater than 1 inch in diameter and other debris shall then be uniformly spread over all disturbed areas to a minimum depth of 4 inches. The topsoil should be compacted by tracking a bulldozer with cleated treads vertically on the slopes to create horizontal erosion checks in the surface.
- B. Natural areas consisting of native plants, trees, shrubs, and ground cover shall be seeded per this specification; lawns and grassed areas shall be sodded and shall match existing.

# 3.02 SEEDING AND MULCHING OR MATTING

A. Reseeding shall immediately follow topsoiling with the mixture of grasses and rates of application as specified in the Plans. Seed shall be broadcast evenly over the topsoiled areas by hand or mechanical broadcaster. Mulching shall immediately follow seed application.

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B. Mulching shall be as specified in the Plans. Small brush or tree limbs which are removed during construction may also be passed through a shredder and spread evenly over the ground. Large concentrated accumulations should be avoided.

- C. Seeding along creeks and channels shall be accomplished by stapling in place a geotextile erosion control fabric at disturbed areas followed by seeding. If seeding is lost due to stream flows the Contractor shall reseed at his own expense. Multiple stream flow occurrences may be possible. The matting shall be installed and anchored per manufacturer's recommendations.
- D. Soil Retention Matting shall be placed along the extent

#### 3.03 MAINTENANCE AND WATERING

- A. The CONTRACTOR shall maintain and water the seeded area as necessary to establish acceptable ground coverage. This may be accomplished by truck watering or a temporary irrigation system. No separate payment for watering will be made.
- B. Revegetation shall be acceptable when the grass has grown at least 1 1/2" high with 95% coverage and no bare spots larger than 16 square feet exist.

# 3.04 STREET, DRIVEWAY AND CURB AND GUTTER

A. CONTRACTOR shall repair or replace all asphalt/concrete paving and curb and gutter damaged as a result of construction activity. Including damage caused by equipment tracks. Damaged asphalt and concrete shall be saw cut to a clean edge and removed prior to repairing.

# PART 4: MEASUREMENT AND PAYMENT

A. Payment for seeding topsoiling, and revegetation of the area disturbed during construction shall be included in the "restoration and revegetation" bid item on a per lump sum basis. The lump sum price shall include full compensation for furnishing all materials, labor, and equipment necessary to complete the work.

END OF SECTION 02480

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### **DUCTILE IRON PIPE AND FITTINGS**

## PART 1 GENERAL

# 1.01 SECTION INCLUDES

- A. Ductile iron pipe and fittings for water lines, wastewater force mains, gravity sanitary sewers, and storm sewers.
- B. Ductile iron pipe shall not require cathodic protection to be installed with the exception of the specified coatings, linings, polyethylene encasement, and insulating flange kits at connections to existing pipes and/or pipes of dissimilar metals.

# 1.02 REFERENCES

- A. ANSI A 21.4 (AWWA C 104) Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings, for Water.
- B. ANSI A 21.10 (AWWA C 110) Standard for Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in.
- C. ANSI A 21.11 (AWWA C 111) Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- D. ANSI A 21.15 (AWWA C 115) Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
- E. ANSI A21.16 (AWWA C 116) Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings for Water Supply Service.
- F. ANSI A 21.50 (AWWA C 150) Standard for Thickness Design of Ductile-Iron Pipe.
- G. ANSI A 21.51 (AWWA C 151) Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids.
- H. ANSI A 21.53 (AWWA C 153) Standard for Ductile Iron Compact Fittings, 3 inches through 24 inches and 54 inches through 64 inches for Water Service.
- I. ASME B 16.1 Cast Iron Pipe Flanges and Flanged Fittings.
- J. ASTM D 1248 Standard Specification Polyethylene Plastics Molding and Extrusion Materials for Wire and Cable.
- K. ASTM F 477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- L. ASTM G 62 Standard Test Methods for Holiday Detection in Pipeline Coatings.
- M. AWWA C 102 American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
- N. AWWA C105 Polyethylene encasement for Ductile-Iron Pipe Systems
- O. AWWA C 300 Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids.

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- P. AWWA C 600 Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
- Q. SSPC-SP 6 Steel Structures Painting Council, Commercial Blast Cleaning.
- R. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.
- S. American Association of State Highway Transportation Officials (AASHTO).

# 1.03 SUBMITTALS

- A. Conform to requirements of Item 01300 Submittals.
- B. For pipes 16 inches and greater submit shop drawings signed and sealed by Professional Engineer registered in State of Texas showing the following:
  - 1. Manufacturer's pipe design calculations.
  - 2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, restrained joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Drawings. Do not start production of pipe and fittings prior to review and approval by Engineer. Provide final approved lay schedule on CD-ROM in Adobe portable document format (\*.PDF).
  - 3. Calculations and limits of thrust restraint.
  - 4. Class and length of joint.
- C. Submit manufacturer's certifications that ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51.
- D. Submit certifications that pipe joints have been tested and meet requirements of ANSI A 21.11.
- E. Submit affidavit of compliance in accordance with ANSI A21.16 for fittings with fusion bonded epoxy coatings or linings.

### PART 2 PRODUCTS

# 2.01 DUCTILE IRON PIPE

- A. Ductile Iron Pipe Barrels: Shall conform to AWWA C115, C150 and C151 and bear mark of Underwriters' Laboratories approval. Unless otherwise shown on Drawings, use minimum Pressure Class 250 for water lines.
- B. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.
- C. Hydrostatic Test of Pipe: AWWA C 151, Section 5.2.1, at point of manufacture. Repair or reject pipe revealing leaks or cracks.

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D. Pipe Manufacturer for Large Diameter Water Lines: Minimum of 5 years of successful pipe installations in continuous service. Manufacturer must maintain on site or in plant enough fittings to satisfy the following requirements:

Line Diameter	Required Bends*	
20 and 24 inches	Four 45° bends per 5,000 LF of water line	
> 24 inches	Four 22.5° bends per 10,000 LF of water line	
*Based on total length of contract (minimum of four). Any combination of		
bends may be substituted at manufacturer's option (i.e., two 22.5° bends are		
equivalent to one 45° bend) and will be counted as one fitting.		

Manufacturer or supplier must be capable of delivering bends to job site within 12 hours of notification. Use fittings at direction of Engineer where unforeseen obstacles are encountered during construction. These fittings are in addition to any fittings called out in construction documents and must be available at all times.

- E. Provide flange adapter with insulating kit at all locations when connecting new piping to existing piping and piping of different materials, unless otherwise approved by Engineer.
- F. Clearly mark pipe section to show location and thickness/pressure class color coded.
- G. No field welding of ductile iron pipe is allowed.

### 2.02 JOINTS

- A. Joint Types: ANSI A 21.11 push-on; ANSI A 21.11 mechanical joint; or ANSI A 21.16 flanged end. Provide push-on joints unless otherwise indicated on the Drawings or required by these specifications. For bolted joints, conform to AWWA C111; provide Type 316 stainless steel bolts, nuts and washers where flexible couplings and restraint harnesses are installed underground. For bolted joints conform to AWWA C111; provide Type 316 stainless steel bolts, nuts and washers where flexible couplings and restraint harnesses are installed underground. For flanged joints, use galvanized or cadmium plated steel nuts and bolts.
- B. Where required by Drawings, provide approved restrained joints for buried service. Refer to Austin Standard Products List for approved joint restraining mechanisms.
- C. Threaded or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.
- D. Provide for restrained joints designed to meet test pressures required under Item 02515 Hydrostatic Testing of Pipelines. Provide restrained joints for test pressure or maximum surge pressure as specified, whichever is greater for water lines. Do not use passive resistance of soil in determining minimum restraint lengths.
- E. Electrical Bond Wires: Bond wires; use stranded, copper cable furnished with high molecular weight polyethylene insulation (HMWPE). Use wire gauge (AWG) as shown on Drawings.
- F. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer for pipe joints or restraint joints. Submit details of other methods of providing curves and bends for consideration by Engineer. When other methods are deemed satisfactory, install at no additional cost to Owner.

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# 2.03 GASKETS:

A. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material in accordance with ANSI A21.11 or ASTM F 477 (One Bolt only); for flanged joints 1/8-inch-thick gasket in accordance with ANSI A 21.15.

## 2.04 FITTINGS

- A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they connect to.
- B. Fittings Fittings shall be push-on, flanged or mechanical joint as indicated or approved. For sizes 4-inch through 24-inch diameter, fittings shall meet AWWA C-110 or AWWA C-153. For sizes larger than 24-inch diameter, fittings shall meet AWWA C-110. Where not indicated otherwise, interior surfaces for all water pipe fittings shall be lined with cement mortar and seal coated per AWWA C104.

# 2.05 COATINGS AND LININGS

- A. Water Line Interiors: ANSI A21.4, cement lined with seal coat.
- B. Encasement and coating requirements:
  - 1. Open cut construction method:
    - a. Provide double wrap polyethylene encasement applied in accordance with AWWA C105.
  - 2. Auger or casing construction method:
    - a. Polyethylene Wrap Provide polyethylene double wrap unless otherwise specified or shown.
- C. For flanged joints in buried service, provide petrolatum wrapping system, Denso, or equal, for the complete joint and alloy steel fasteners. Alternatively, provide bolts made of Type 304 stainless steel.

### 2.06 MANUFACTURERS

A. Use pre-approved manufacturers listed in City of Austin Standard Products list.

### PART 3 EXECUTION

# 3.01 INSTALLATION

- A. Conform to installation requirements of Items 02511 Large Diameter Water Lines except as modified in this Section.
- B. Install in accordance with AWWA C 600 and manufacturer's recommendations.
- C. Install all ductile iron pipe in double polyethylene wrap per AWWA C105.

# D. Holiday Testing:

- 1. Polyurethane: Conform to requirements of Item 02527 Polyurethane Coatings for Steel or Ductile Iron Pipe.
- 2. Fusion Bonded Epoxy: Conform to requirements for new fittings in ANSI A 21.16.

# 3.02 FIELD REPAIR OF COATINGS

- A. Polyurethane: Conform to requirements of Item 02527 Polyurethane Coatings for Steel or Ductile Iron Pipe.
- B. Fusion Bonded Epoxy: Conform to requirements for new fittings in ANSI A 21.16.

# PART 4 MEASUREMENT

- 4.01 If indicated in the plans and bid form, ductile iron mains shall be the horizontal distance measured along the axis of the pipe and include fittings and restrained joints where applicable.
- 4.02 No separate payment shall be made for ductile iron pipe or fittings required for fire hydrants or other appurtenances, items shall be included in the associated bid items.
- 4.03 Ductile iron fittings for installation on ductile iron and PVC water mains, services, fire hydrants, and appurtenances shall be included in those associated bid items, no separate payment shall be made.

#### PART 5 PAYMENT

- 5.01 If indicated as a separate bid item in the bid form, payment is based on a per linear foot basis for each size of ductile iron pipe installed, and includes all fittings, outlets, and appurtenances.
- 5.02 Connection to existing waterline, per each for each size of pipe

#### DISINFECTION OF WATER LINES

PART 1: GENERAL

### 1.01 SECTION INCLUDES

A. Disinfection of potable water lines.

### 1.02 REFERENCES

A. AWWA C 651 - Standard for Disinfecting Water Mains.

PART 2: PRODUCTS - Not Used

PART 3: EXECUTION

# 3.01 CONDUCTING DISINFECTION

- A. Protect all pipes, valves and appurtenances from contamination during storage, handling and installation. Clean, dry, and remove all obstructions from pipe interior prior to disinfection. Close pipeline openings with watertight plugs each day when pipe laying is complete.
- B. Promptly disinfect water lines constructed before tests are conducted on water lines and before water lines are connected to City of Leander water distribution system.
- C. Water for disinfection and flushing will be furnished by City of Leander without charge.
- D. Unless otherwise provided in Contract Documents, Contractor will conduct disinfection operations.
- E. Coordinate chlorination operations through Engineer.

### 3.02 PREPARATION

- A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials, and other items needed to facilitate disinfection of new water lines prior to connection to Public water distribution system. Normally, each valved section of water line requires two each 3/4-inch taps. A 2-inch minimum blow-off is required for water lines up to and including 6-inch diameter.
- B. Use fire hydrants as blow-offs to flush newly constructed water lines 8-inch diameters and above. Where fire hydrants are not available on water lines, install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.

- C. Slowly fill each section of pipe with water in manner approved by Engineer. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.
- D. Backfill excavations immediately after installation of risers or blow-offs.
- E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to Drawings.

### 3.03 DISINFECTION BY CONTRACTOR

- A. The following procedure will be used when disinfection by Contractor is required by Contract Documents:
  - 1) Use not less than 100 parts of chlorine per million parts of water.
  - 2) Introduce chlorinating material to water lines in accordance with AWWA C651.
  - 3) After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 parts per million parts of water.
  - 4) Open and close valves in lines being sterilized several times during contact period.
  - 5) If chemical compound is used for sterilizing agent, place in pipes as directed by Engineer.

# 3.04 BACTERIOLOGICAL TESTING

A. After disinfection and flushing of water lines by Contractor, bacteriological tests samples will be taken by Contractor to a City of Leander approved testing laboratory. If test results indicate need for additional disinfection of water lines based upon Texas Department of Health requirements, the Contractor will perform additional disinfection operations at no additional cost.

### 3.05 FINAL FLUSHING

- A. Carefully flush heavily chlorinated water from the water line until the chlorine concentration is no higher than the residual generally prevailing in the existing distribution system. Handle, dilute, and dispose of chlorine solution while avoiding injury or damage to the public, water system or environment. Submit flushing plan to Engineer for review and approval before flushing the line. Flushing must be witnessed by an authorized City representative.
- B. Obtain approval for discharge of dechlorinated water into the storm water system from City of Leander and storm water system owner. Regulate line flushing operations so as not to overload the storm water system. The Owner may

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designate a representative to oversee the work. Daily notice of line discharging must be reported to Owner.

# PART 4: MEASUREMENT AND PAYMENT

4.01 No separate payment shall be made for this item.

END OF SECTION 02514

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#### HYDROSTATIC TESTING FOR WATER LINES

# PART 1: GENERAL

### 1.01 SECTION INCLUDES

A. Field hydrostatic testing of large diameter water pipelines.

### 1.02 MEASUREMENT AND PAYMENT

### A. Unit Prices:

1) No payment will be made for hydrostatic testing of pipelines under this Section. Include cost in unit price of pipelines being tested.

### PART 2: PRODUCTS - Not Used

# PART 3: EXECUTION

# 3.01 PREPARATION

- A. Hydrostatically test newly installed water pipelines.
- B. Water for testing will be charged to Contractor. Prior to hydrostatic testing, obtain a transient meter from the Owner. Deposit is required for transient meter.
- C. Test pipelines between valves or plugs, 4,100 linear feet maximum length for 24-inch diameter and larger water lines.
- D. Conduct hydrostatic tests in presence of Engineer.

### 3.02 TEST PROCEDURES

- A. Furnish, install, and operate connections, pump, meter and gages necessary for hydrostatic testing. Use certified pressure gauges from 0 to 160 psi in 1/2-lb increments. Run rest pump continuously throughout the duration of the test. The discharge side of the pump should be equipped with a regulator/pressure relief valve to ensure a constant specified test pressure. Use a meter and flow chart approved by Engineer during test procedure.
- B. Allow pipeline to sit minimum of 24 hours from time it is initially filled until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.
- C. For large diameter water lines, expel air and apply minimum test pressure of 150% of the working pressure.

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- D. Begin test by 9:00 a.m. unless otherwise approved by Engineer. Maintain test pressure for 8 hours. When large quantity of water is required to maintain pressure during test, discontinue testing until cause of water loss is identified and corrected.
- E. When testing a section of pipe between valves, applying hydrostatic pressure to the opposite side of an isolation valve is not allowed, unless otherwise approved by Engineer.

### 3.03 ALLOWABLE LEAKAGE FOR WATERLINES

- A. During hydrostatic tests, no leakage will be allowed for sections of water lines consisting of welded joints.
- B. Maximum allowable leakage:
  - 1) Leakage shall be defined as the quantity of water that must be supplied into any test section of pipe to maintain the specified leakage test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. No pipe installation will be accepted if leakage exceeds the amount given by the formula: [Allowable Leakage (gal/hr) = (L x D)/10,875]. Where L = length of pipe tested in feet, and D = nominal pipe diameter in inches. The leakage test will follow pressure testing of the pipeline. The Contractor assumes all risks associated with testing against valves. The leakage test shall be conducted at 150 psi for at least 2 hours. The test pressure shall not vary by more than plus or minus 5 psi for the duration of the test.
  - 2) Water lines with welded and flanged joints only: zero allowable leakage.
  - 3) No leakage is allowed through any valve.

# 3.04 CORRECTION FOR FAILED TESTS

- A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.
- B. Repeat test until satisfactory results are obtained at no additional cost to Owner.

# 3.05 COMPLETION

A. Upon satisfactory completion of testing, remove risers remaining from hydrostatic testing, and backfill excavation promptly.

### PART 4: MEASUREMENT AND PAYMENT

A. No separate payment shall be made for this item.

### **END OF SECTION 02515**

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# DEWATERING AND DRAINAGE OF EXCAVATIONS

# PART 1: DESCRIPTION

#### 1.01 SCOPE OF WORK

A. This section provides for furnishing all labor, materials, equipment, power and incidentals, and for performing all operations necessary to dewater, drain and maintain excavations and foundation beds as described herein and as necessary for construction of structures and appurtenances. Included are construction, maintenance and removal of cofferdams; installing, maintaining, operating and removing well point systems and other approved devices for lowering the water table within an excavation; removal of standing water, surface drainage and seepage from excavation or other work, and protecting work against rising waters and floods, and repair of any resulting damage.

### 1.02 PERFORMANCE REQUIREMENTS

- A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems.
- B. Design a dewatering system to perform as follows:
  - 1) Effectively reduce the hydrostatic pressure affecting excavations.
  - 2) Develop a substantially dry and stable subgrade for subsequent construction operations.
  - 3) Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities, and other work.
  - 4) Prevent the loss of fines, seepage, boils, quick conditions, or softening of the foundation strata.
  - 5) Maintain stability of sides and bottom of excavations.
- C. Methods of dewatering include sump pumping, single or multiple stage well point systems, eductor and ejector type systems, deep wells, and combinations thereof.
- D. Provide drainage of seepage water and surface water, as well as water from any other source entering the excavation. Excavation drainage may include placement of drainage materials, such as crushed stone and filter fabric, together with sump pumping.
- E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.

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- F. Locate dewatering facilities where they shall not interfere with utilities, construction operations, adjacent properties, or adjacent water wells.
- G. Assume sole responsibility for dewatering systems and for any loss or damage resulting from partial or complete failure of protective measures and any settlement or resultant damage caused by ground water control operations. Modify dewatering systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells, or affect potentially contaminated areas. Repair damage caused by dewatering systems or resulting from failure of the system to protect property as required.

### 1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Subsurface Investigation: Section 02010.
- B. Trenching, Backfilling, Embedment and Encasement: Section 02225.
- C. Environmental Protection: Section 01014

# 1.04 SUBMITTALS

- A. Submittals shall comply with the requirements in Section 01300.
- B. Submit plans for review of proposed methods of dewatering, foundation drainage and diversion, in accordance with sound engineering practice.
  - 1) Results of subsurface investigation and description of the extent and characteristics of water bearing layers subject to groundwater control.
  - 2) Names of equipment suppliers and installation subcontractors.
  - 3) A description of the proposed dewatering system indicating arrangement, location, depth and capacity of system components, installation details and criteria, and operation and maintenance procedures.
  - 4) A description of proposed filters including types, sizes, capacities and manufacturer's application recommendations.
  - 5) Design calculations demonstrating adequacy of the proposed dewatering system.
  - 6) Excavation drainage methods including typical drainage layers, sump pump application and other necessary means.
  - 7) Well Point System. Show the well point system in clear detail, including the pump capacity, or other proposed method for lowering the water table within the areas where the siphon pipe, concrete structures, compacted fill and backfill are to be constructed.

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- 8) Surface water control and drainage installations.
- 9) Proposed methods and locations for disposing of removed water.
- 10) Proposed method of removing sediment before disposing of removed water.
- 11) Weekly records of flow rates obtained during monitoring of dewatering and depressurization.
- 12) Weekly maintenance records for ground water control installations.
- C. Review. Do not start dewatering until plans and other data required in this paragraph are reviewed.

# PART 2: PRODUCTS

#### 2.01 EQUIPMENT AND MATERIALS

- A. Equipment and materials are at the option of the Contractor as necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review of the Engineer through submittals required in Section 01300, Submittals.
- B. Eductors, well points, or deep wells, where used must be furnished, installed and operated by an experienced contractor regularly engaged in ground water control system design, installation, and operation.
- C. All equipment must be in good operating order and repair.
- D. Sufficient standby equipment and materials shall be kept available to ensure continuous operation, where required.

### PART 3: EXECUTION

#### 3.01 DEWATERING EXCAVATIONS

- A. Perform dewatering in accordance with approved Shop Drawings. Monitor the effectiveness of the installed system and its effect on adjacent property. Keep the Engineer advised of any changes made to accommodate field conditions and, on completion of the dewatering system installation, revise and resubmit Shop Drawings necessary to indicate the installed configuration.
- B. Provide for continuous system operation, including nights, weekends, and holidays. Arrange for appropriate backup if electrical power is the primary energy source for the dewatering system.
- C. During backfilling, dewatering may be reduced to maintain water level a minimum of 5 feet below prevailing level of backfill. However, do not allow water level to

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result in uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement stabilized sand until at least 48 hours after placement.

- D. Provide a uniform diameter for each pipe drain run constructed for dewatering. Remove the pipe drain when it has served its purpose. If removal of the pipe is impractical, provide grout connections at 50-foot intervals, and fill the pipe with clay grout or cement and sand grout when the pipe has served its purpose.
- E. Prevent discharge of sediments to adjacent lands or waterways by whatever means necessary. Methods of sediment removal may include settling basins, portable settling tanks, filter boxes, weir tanks, dewatering tanks, dewatering bags, or filters. Removed sediment shall be disposed of off-site.
- F. Remove system upon completion of construction or when dewatering and control of surface or ground water is no longer required.
- G. Replace any excavation performed for convenience in the foundation beds with materials as impermeable as the original foundation material, and compacted to not less than 95 percent maximum density.

### 3.02 DRAINAGE OF FOUNDATION BEDS

- A. Dewater foundation beds for concrete structures by using well points or another approved method. Maintain the saturation line at least one foot below the lowest elevations where concrete or embankment or scour protection is to be placed.
- B. Dewater foundation beds for embankments or scour protection so that the surface on which the materials are to be placed will be dry and firm.
- C. Produce a downward seepage of water through the sandy materials in the foundation beds, promoting their compaction as the water table drops. Be prepared to demonstrate that the method proposed will produce the desired results. Be prepared to adopt other means of obtaining these effects if the proposed method fails.
- D. In areas where concrete is to be placed, carry out the foundation drainage so that the required lowering of the water table will be affected prior to placing reinforcing steel. Keep foundation beds free from water to the same levels for 3 days after pouring concrete.

# 3.03 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

- A. For aboveground piping in a ground water control system, include a 12-inch minimum length of clear, transparent piping between every eductor well or well point and discharge header so that discharge from each installation can be visually monitored.
- B. Install piezometers or monitoring wells not less than one week in advance of beginning the associated excavation.

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- C. Install sufficient piezometers or monitoring wells to show that all trench or shaft excavations in water bearing materials are predrained prior to excavation. Install separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for Contractor's selected method of work.
- D. Well points may be omitted for portions of underdrains or other trenches, only where auger borings and piezometers show that the soil is predrained by an exterior system such that the criteria of the dewatering plan are satisfied.
- E. Replace installations that produce noticeable amounts of sediment after development.
- F. Provide additional ground water control installations, or change the methods, in the event that the installations according to the dewatering plan do not provide satisfactory results based on the performance criteria defined by the plan and by the specification. Submit a revised plan.

# 3.04 DRAINAGE OF EXCAVATIONS

A. Contractor may use excavation drainage methods if necessary to achieve well drained conditions. The excavation drainage may consist of a layer of crushed rock and filter fabric, and sump pumping in combination with sufficient wells for ground water control to maintain stable excavation and backfill conditions.

## 3.05 MONITORING AND RECORDING

A. Observe and record the average flow rate and time of operation of each pump used in the dewatering system. Where necessary provide appropriate devices, such as flow meters, for observing the flow rates. Submit data weekly during the period that the dewatering system is in operation.

#### 3.06 SURFACE WATER CONTROL

A. Intercept surface waters and divert away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. The requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

# 3.07 REPAIR OF DAMAGE

A. Assume full responsibility for all loss and damage due to flood, rising water or seepage in any part of the work. Repair any damage to partially completed work from these or other causes, including the removal of slides, repair of foundation beds and performance of any other work necessitated by failure or lack of adequate dewatering or drainage facilities.

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# PART 4: MEASUREMENT AND PAYMENT

A. No separate payment shall be made for this item.

END OF SECTION 02530

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### STABILIZED CONSTRUCTION ENTRANCE

### PART 1: DESCRIPTION

A. This item involves constructing a stabilized pad of crushed stone located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking or deposition of sediment onto public right of way.

# PART 2: MATERIALS

A. Aggregate for construction shall conform to the following gradation:

Table 1				
Aggregate Gradation Chart (TEX 401-A, Percent Retained)				
8 inch	5 inch	2 inch		
0	90-100	100		

#### PART 3: CONSTRUCTION METHODS

- A. All trees, brush, stumps, obstructions and other objectionable material shall be removed and disposed of so as not to interfere with the excavation and construction of the entrance as indicated. The entrance shall not drain onto the public right-of-way or leave the construction site.
- B. When necessary, vehicle wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, boards, silt fence or other approved methods.
- C. The entrance shall be maintained in a condition which will prevent tracking or disposition of sediment onto public right-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public right-of-way must be removed immediately.

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# PART 4: MEASUREMENT AND PAYMENT

A. Acceptable work performed as prescribed in this item will be measured by the number of each stabilized construction entrance installed. The work and materials prescribed herein will be included in the lump sum cost related to erosion and sedimentation control, see specification section 01014.

**END OF SECTION 02641** 

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SECTION 02642 SILT FENCE

### **SECTION 02642**

### SILT FENCE

### PART 1: DESCRIPTION

A. This item shall consist of providing and placing a filter fabric fence including maintenance of the fence, removal of accumulated silt and removal of the fence upon completion of the project.

### PART 2: MATERIALS

### A. Fabric

- 1) General: The filter fabric shall be of nonwoven polypropylene, polyethylene or polyanide thermoplastic fibers with non-ravelling edges. The fabric shall be nonbiodegradable, inert to most soil chemicals, ultraviolet resistant, unaffected by moisture or other weather conditions, and permeable to water while retaining sediment. The filter fabric shall be supplied in rolls a minimum of 36 inches wide.
- 2) Physical Requirements: The fabric shall meet the following requirements when sampled and tested in accordance with the methods indicated.

Physical Properties	Method	Requirements
Fabric Weight (oz/sy)	TEX-616-J	4.5 minimum
Water Flow Rate: (gal/sq. ft/minute)	TEX-616-J	80 maximum
Equivalent Opening Size: US Standard sieve (number)	CW-02215, US Army Corps of Engineers	40 to 100
Mullen Burst Strength: (psi)	ASTM D 3786	300 minimum
Ultraviolet Resistance; Strength retention: (%)	ASTM D 1682	70 minimum

- B. Posts: Posts shall be painted or galvanized steel Tee or Y-posts with anchor plates, not less than 5 feet in length with a minimum weight of 1.3 pounds per foot with a minimum Brinell Hardness of 143. Hangers shall be adequate to secure fence and fabric to posts. Posts and anchor plates shall conform to ASTM A 702.
- C. Wire Fence: Wire fence shall be welded wire fabric 2x4-WI, OxWI.0.

### PART 3: CONSTRUCTION METHODS

A. The silt fence fabric shall be securely attached to the posts and the wire support fence with the bottom 12 inches of the filter material buried in a trench a minimum

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SECTION 02642 SILT FENCE

of 6 inches deep and 6 inches wide to prevent sediment from passing under the fence. When the silt fence is constructed on impervious material, a 12 inch flap of fabric shall be extended upstream from the bottom of the silt fence and weighted to limit particulate loss. No horizontal joints will be allowed in the filter fabric. Vertical joints shall be overlapped a minimum of 12 inches with the ends sewn or otherwise securely tied.

- B. The silt fence shall be a minimum of 24 inches high. Posts shall be embedded a minimum of 12 inches in the ground, placed a maximum of 8 feet apart and set on a slight angle toward the anticipated runoff source. When directed by the Engineer, posts shall be set at specified intervals to support concentrated loads.
- C. The silt fence shall be repaired, replaced, and/or relocated when necessary or as directed by the Engineer. Accumulated silt shall be removed when it reaches a depth of 6 inches.

# PART 4: MEASUREMENT AND PAYMENT

- A. The work performed and the materials furnished under this item will be included in the lump sum cost for work associated with erosion and sedimentation controls, see specification section 01014.
- B. Silt fence must be removed upon acceptance of revegetation and authorization of owner's representative.

END OF SECTION 02642

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#### **SECTION 02803**

## BARRICADES, SIGNS AND TRAFFIC HANDLING

#### PART 1: DESCRIPTION

A. This item shall consist of providing, installing, moving, replacing, maintaining, cleaning and removing temporary or permanent street closure barricades, signs or other devices required to handle the traffic in conformance with the current edition of the Texas Manual of Uniform Traffic Control Devices for Street and Highways and as indicated or directed by the Engineer.

## PART 2: PRODUCTS

All materials used in barricades, signs and traffic handling shall conform to the following:

#### 1) SIGNS

- a) Sign Plates .080 in thickness alodine finished Federal Specification 6061 T6 aluminum
- b) Sign Posts 1.25 ounce/square foot hot dipped galvanized welded steel tubing ASTM A 513, O.D. 2.375 inches, wall thickness .065 inch, 1.60 pounds per foot.
- c) Hardware Aluminum alloy ASTM A 444 sign hardware for clamp casting or stainless steel with galvanized or electroplated cold rolled steel U bolts, bolts, washers and nuts.

## 2) SIGN PLATE MESSAGE AND SIZE

- a) Sign Designation Size
- b) OM-4R 18 inch x 18 inch
- c) W14-1 30 inch x 30 inch

## 3) LUMBER

- a) Rails shall be new unweathered S4S grade #2 fir or yellow pine, of the size indicated.
- b) Posts, of the size indicated, shall be pressure treated with pentachlorophenol.

#### 4) CONCRETE

a) Concrete shall be 4000 psi Concrete conforming to Section 03305.

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## 5) RETRO-REFLECTIVE SHEETING

a) Red and white strips shall conform to Table 1 CIE Chromaticity Coordinates, ASTM Designation D 523, ASTM 39". SDHPT Test Method Tex-842-B, ASTM D-987-48%, Atlas Twin ARC Weathering ASTM E 42-69, Type E conforming to ASTM D 822-60X which requires the ASTM E 42 Type E Atlas XW data; L-2300B dated January 7, 1970.

## 6) PAINT

a) Exterior Oil base paint, colors as indicated.

## PART 3: EXECUTION

- A. Prior to commencing construction, suitable "Barricades, Signs and Traffic Handling" devices shall be installed to protect the workers and the public.
- B. The Contractor shall be responsible for installing all markers, signs and barricades conforming to the Manual on Uniform Traffic Control Devices and/or as indicated. If, in the opinion of the Engineer, additional markers, signs or barricades are needed in the interest of safety, the Contractor will install such as are required or as directed by the Engineer.
- C. Maintenance It shall be the Contractor's responsibility to maintain, clean, move and replace if necessary, barricades, signs and traffic handling devices during the time required for construction of the project. Permanent barricades shall be constructed as required after the completion of the street by drilling holes to place the posts and concrete foundations. Foundation concrete shall be cured before the rails are attached. When no longer needed all temporary Barricades, Signs and Traffic Handling Devices shall be removed and the area restored to its original condition or as directed by the Engineer.

#### PART 4: MEASUREMENT AND PAYMENT

A. Payment will be made for work performed and material furnished for traffic control measures under the lump sum price bid for traffic controls.

**END OF SECTION 02803** 

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#### **SECTION 03305**

#### CONCRETE FOR UTILITY CONSTRUCTION

#### PART 1: GENERAL

#### 1.01 SECTION INCLUDES

A. This item shall govern quality, storage, handling, proportioning and mixing of materials for concrete construction of slabs on grade, vaults, site cast bases culverts, and incidental appurtenances.

#### 1.02 SUBMITTALS

- A. Submittals shall conform to Section 01300 Submittals.
- B. Mix designs and laboratory test data for each class of concrete required on the project.
- C. The supplier of the concrete mix designs and type of mixing equipment.
- D. Type of admixtures to be used with the concrete mixes
- E. Furnish shop bending diagrams, placing lists and drawings of all reinforcement steel prior to fabrication.
- F. Submit manufacturer's mill certificates for reinforcing steel.

## 1.03 REFERENCES

- A. ACI 117 Standard Tolerances for Concrete Construction and Materials.
- B. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
- C. ACI 302.1R Guide for Concrete Floor and Slab Construction.
- D. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- E. ACI 308 Standard Practice for Curing Concrete.
- F. ACI 309R Guide for Consolidation of Concrete.
- G. ACI 311 Batch Plant Inspection and Field Testing of Ready Mixed Concrete.
- H. ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures.
- I. ACI 318 Building Code Requirements for Reinforced Concrete.

- J. ACI 544 Guide for Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.
- K. ASTM A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- L. ASTM A185 Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Encasement.
- M. ASTM A615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- N. ASTM A767 Standard Specifications for Zinc-coated (Galvanized) Bars for Concrete Reinforcement.
- O. ASTM A775 Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- P. ASTM A820 Steel Fibers for Fiber Reinforced Concrete.
- Q. ASTM A884 Specification for Epoxy-coated Steel Wire and Welded Wire Fabric for Reinforcement.
- R. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- S. ASTM C33 Standard Specification for Concrete Aggregates.
- T. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- U. ASTM C42 Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- V. ASTM C94 Standard Specification for Ready-Mixed Concrete.
- W. ASTM C138 Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.
- X. ASTM C143 Standard Test Method for Slump of Hydraulic Cement Concrete.
- Y. ASTM C150 Standard Specification for Portland Cement.
- Z. ASTM C172 Standard Practice for Sampling Freshly Mixed Concrete.
- AA. ASTM C173 Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.
- BB. ASTM C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- CC. ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete.

- DD. ASTM C309 Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
- EE. ASTM C494 Standard Specification for Chemical Admixtures for Concrete.
- FF. ASTM C595 Standard Specification for Blended Hydraulic Cements.
- GG. ASTM C685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
- HH. ASTM C1064 Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
- II. ASTM C1077 Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.
- JJ. CRSI MSP-1 Manual of Standard Practice
- KK. CRSI Placing Reinforcing Bars.
- LL. Federal Specification SS-S-210A Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.
- MM. NRMCA Concrete Plant Standards.

#### PART 2: PRODUCTS

## 2.01 CONCRETE MATERIALS

#### A. Cementitious Materials:

- 1) Portland cement shall conform to ASTM C 150, Type I (General Purpose); Type II (General Purpose with Moderate Sulfate Resistance); or Type III (High Early Strength). Concrete to be in contact with sewage or in areas where sewer gases are present shall use Type II cement. Use of Type III cement must be authorized by the Engineer. All cement shall be of the same type and from the same source for a monolithic placement.
- 2) When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in the form of Na<sub>2</sub>O + 0.685K<sub>2</sub>O.
- 3) Fly ash (denoted by TEX designations Type A and Type B) may replace 20 to 35 percent of a mix design's Portland cement by absolute volume. Fly ash shall not be used in mix designs with less than five sacks of Portland cement per cubic yard unless specifically permitted by the contract Drawings or project manual. Fly ash may be used in all other classes of concrete, except that Type B fly ash shall not be used with Type II cement.
- B. Mixing Water shall be clean, free from harmful amounts of oils, acids, alkalis or other deleterious substances, and meeting the requirements of ASTM C94.

## C. Aggregates:

- Coarse aggregate shall conform to ASTM C33. Unless otherwise indicated, use the following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Coarse aggregates shall not be larger than 1/5 of the narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.
- 2) Fine aggregates shall conform to ASTM C33.
- 3) The combined aggregate proposed for use in the minor concrete shall be submitted as part of the mix designs for the project.
- 4) Aggregates shall be washed and consist of clean, hard, durable and uncoated particles of natural or manufactured sand or combination thereof.

#### D. Admixtures:

- All admixture submittals must be approved by the Engineer. No admixture shall be chloride-based or have chloride(s) added in the manufacturing process. Admixtures must be pretested by the Texas Department of Transportation (TXDOT) Materials and Tests Engineer and be included in the State's current approved admixture list.
- 2) Air entraining admixtures shall conform to ASTM C260.
- 3) Chemical Admixtures
  - a) Water reducers shall conform to ASTM C494, Type A.
  - b) Water reducing retarders shall conform to ASTM C494, Type D.
  - c) High range water reducers (superplasticizers) shall conform to ASTM C494, Types F and G.

## E. Reinforcing Steel:

- 1) New billet steel bars conforming to ASTM A615, ASTM A767, or ASTM A775, grade 60 shall be used as shown. Deformed bars shall be used unless smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.
- 2) Where shown, use welded wirer fabric with wire conforming to ASTM A185 or ASTM A884. Supply the gage and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.
- 3) Wire: ASTM A82. Use 16-1/2 gage minimum for tie wire, unless otherwise indicated.
- F. Curing compounds shall be Type 2 white-pigmented liquid membrane forming compounds conforming to ASTM C309.

## 2.02 FORMWORK MATERIALS

- A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair the finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2-inch (nominal) lumber, or ¾-inch form plywood backed adequately to prevent misalignment. General use: Provide lumber of 1-inch nominal thickness or form plywood of approved thickness.
- B. Formwork for exposed concrete indicated to receive rubbed finish shall be free of irregularities; plywood of 1/4-inch minimum thickness, preferably oiled at the mill.
- C. Chamfer strips and similar moldings shall be redwood, cypress or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.
- D. Form ties shall be metal or fiberglass of approved type with tie holes not larger than 7/8-inch diameter. Do not use wire ties or snap ties.
- E. Metal forms shall be clean and in good condition free from dents and rust, grease or other foreign material that tend to disfigure or discolor concrete in a gage and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present a smooth surface and which line up properly.

#### 2.03 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to ASTM C94 or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C685.

#### 2.04 MEASUREMENT OF MATERIALS

- A. Water shall be accurately metered by volume. Fine and coarse aggregates, mineral filler, cement and fly ash shall be weighed separately. Allowances shall be made in the water volume and aggregate weights during batching for moisture content of aggregates and admixtures. Volumetric and weight measuring devices shall be acceptable to the Engineer or designated representative.
- B. Batch weighing of sacked cement is not required; however, bags, individually and entire shipments, may not vary by more than 3 percent from the specified weight of 94 pounds per bag. The average bag weight of a shipment shall be determined by weighing 50 bags taken at random.

#### 2.05 MIX DESIGN

A. The CONTRACTOR shall furnish a mix design acceptable to the Engineer or designated representative for the class of concrete specified. The mix shall be designed by a qualified commercial laboratory in accordance with ASTM C1077 and signed/sealed by a registered Professional Engineer, licensed in the state of

- Texas to conform with requirements contained herein. Complete concrete design data shall be submitted to the Engineer or designated representative for approval.
- B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification.
- C. Admixtures which meet this specification may be used with the approval of the Engineer provided that specific requirements of the governing concrete structure specification are met. Unless specifically approved by the Engineer or designated representative, mix designs shall not exceed air contents for extreme exposure conditions as recommended by ACI 211.1.

#### D. Classification:

		MIN. COMPRESSIVE		MIN. CEMENT	MAX.	AIR	SLUMP
			GTH (psi)	PER CY	W/C	CONTENT	RANGE
CLASS	TYPE	7-DAY	28-DAY	(lbs)	RATIO	(%)	(inches)
Α	General	2100	3000	470	6.5	4 ± 1	2 to 4*
В	Ballast,	1400	2000	376	8.0	4 ± 1	5 to 7
	Encasement,						
	Thrust Block						
S	Structural	2800	4000	564	5.0	4 ± 1	2 to 4*

<sup>\*</sup>When ASTM C494, Type F or G admixture is used to increase workability, this range may be 6 to 9.

- E. Steel or polypropylene fibers shall only be added when called for on the Drawings or the Specifications.
- F. Determine air content in accordance with ASTM C138, ASTM C173 or ASTM C231.
- G. Use of concrete classes: Use classes of concrete as indicated on the drawings and other specifications. Use Class B concrete for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, and concrete fill unless indicated otherwise.

#### 2.06 PVC WATERSTOPS

- A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that the material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.
- B. Flat Strip and Center Bulb Waterstops shall not be less than 3/8-inch in thickness and shall be as detailed, and as manufactured by: Kirkhill Rubber Co., Brea, California; Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or equal as approved by the Engineer.

## 2.07 ADHESIVE WATERSTOP

- A. Adhesive waterstop shall be at least 2 inches in diameter and shall be Synko-Flex preformed plastic adhesive waterstop by Synko-Flex Products, Inc., or approved equal. The waterstop shall meet or exceed requirements of Federal Specification SS-S-210A.
- B. The adhesive waterstop shall be supplied wrapped completely by a two part protective paper.
- C. The adhesive waterstop material shall have independent laboratory tests verifying that the material seals joints in concrete against leakage when subjected to a minimum of 30 psi water pressure for at least 72 hours.
- D. Primer, to be used on hardened concrete surfaces, shall be provided by the same manufacturer as the waterstop material.

#### PART 3: EXECUTION

#### 3.01 FORMS AND SHORING

- A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within the tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate cleanout openings. Before placing concrete, remove extraneous matter from within forms.
- B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.
- C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.
- D. Back formwork with a sufficient number of studs and wales to prevent deflection.
- E. Re-oil or lacquer the liner on the job before using. Facing may be constructed of 3/4 –inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.
- F. Unless otherwise indicated form outside corners and edges with triangular ¾-inch chamfer strips.
- G. Remove metal form ties to depth of at least ¾-inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by the Engineer, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before the concrete is placed, wet surface of forms which will come in contact with concrete.

#### 3.02 PLACING REINFORCEMENT

- A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by Engineer and obtain acceptance prior to placing concrete.
- B. Minimum spacing center-to-center of parallel bars shall be 2-1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar, unless otherwise shown on the drawings, shall be 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.
- C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.
- D. Do not splice bars without written approval of Engineer. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapter 7 and 12, and as shown on the drawings. Stagger splices or locate at points of low tensile stress.

## 3.03 EMBEDDED ITEMS

- A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping and other embedded items in forms.
- B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joins as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

## 3.04 BATCHING, MIXING AND DELIVERY OF CONCRETE

- A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C94, Section 8 through 11. Produce ready-mixed concrete using an automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 Plant Control Systems.
- B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C685, Section 6 through 8.

- C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of Engineer before adjustment and change of mix proportions.
- D. Ready-mixed concrete delivered to the site shall be accompanied by batch tickets providing the information required by ASTM C94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing the information required by ASTM C685, Section 14.
- E. Concrete mix temperature shall not exceed 90 degrees F except in mixes with high range water reducers where a maximum mix temperature of 100 degrees F will be allowed. Cooling an otherwise acceptable mix by addition of water or ice during agitation will not be allowed. Ice may be used during hot weather concrete placement to lower the concrete temperature; however, the CONTRACTOR shall furnish a mix design acceptable to the Engineer or designated representative for class of concrete specified. The addition of ice shall not exceed 50% of the total mix water weight.
- F. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when the air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in the shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until concrete has cured for a minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.
- G. Clean, maintain and operate equipment so that it thoroughly mixes material as required.
- H. Hand-mix only approved by the Engineer.

## 3.05 PLACING CONCRETE

- A. Give sufficient advance notice to Engineer (at least 24 hours prior) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. No concrete shall be placed without Engineer's approval.
- B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, if necessary to continue after daylight hours, light the site as required. If rainfall occurs after placing operations are started, provide covering to protect the concrete.
- C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs, and pipes clean and free from coating of hardened concrete. Allow no aluminum material to be in contact with concrete.
- D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken on initial set; do not place any strain on projecting reinforcement or anchor bolts.

- E. Use tremies for placing concrete in walls and other narrow or restricted locations. Us tremies made in section, or provide in several lengths, so that outlet may be adjusted to proper height during placement operations.
- F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.
- G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for the size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move the vibrator vertically through the layer of concrete just placed and several inches into plastic layer below. Don not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow of concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.
- H. Handling and placing of concrete shall conform to ACI 302.1R, ACI 304R and ACI 309R.

#### 3.06 WATERSTOPS

- A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for the extent of the joint; make splices necessary to provide such continuity in accordance with manufacturer's instruction. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.
- B. Install waterstops in concrete on one side of joints, leaving the other side exposed until the next pour. When a waterstop will remain exposed for 2 days or more, shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.
- C. Splicing PVC Waterstops:
  - 1) Splice waterstops by heat-sealing adjacent waterstop sections in accordance with the manufacturer's printed instructions.
  - 2) Butt end-to-end joints of 2 identical waterstop sections may be made in the forms during placement of waterstop material.
  - 3) Prior to placement in formwork, prefabricate all waterstop joints involving more than two ends to be joined together, an angle cut, an alignment change, or the joining of two dissimilar waterstop sections, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon inspection and approval by the Engineer, install prefabricated waterstop joint assemblies in formwork, and butt-weld ends of the 24-inch strips to the straight-run portions of waterstop in the forms.

## D. Setting PVC Waterstops:

1) Correctly position waterstops during installation. Support and anchor waterstops during progress of the work to ensure proper embedment in

- concrete and to prevent folding over of the waterstop by concrete placement. Locate symmentrical halves of watersops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.
- 2) Where a waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to a waterstop in a future concrete placement, terminate the waterstop 6 inches below the top of the wall.
- E. Defective field joints shall be replaced if waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying with the Contract Documents.

## F. Adhesive Waterstop:

- 1) Thoroughly clean the concrete surface on which the waterstop is to be placed with a wire brush and coat with primer.
- 2) If the surface is too rough to allow the waterstop to form a complete contact, grind to form an adequately smooth surface.
- 3) Install the waterstop with the top protective paper left in place. Overlap joints between strips a minimum of 1-inch and cover back over with protective paper.
- 4) Do not remove protective paper until just before final formwork completion. Concrete shall be placed immediately. The time that the waterstop material is uncovered prior to concrete placement shall be minimized and shlal not exceed 24 hours.
- 5) Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.
- 6) Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop a minimum of 6 inches and place in contact with the PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form a smooth joining surface.

## 3.07 CONSTRUCTION JOINTS

A. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water-blasting. Keep surface wet for several hours prior to placing of plastic concrete.

## 3.08 CURING

A. Curing shall comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for a period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from the concrete surface after placing and finishing. A curing day is any calendar day in which the temperature is above 50 degrees F for at least 19 hours. Colder days may be counted if air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at the end of calendar days equal to twice

the required number of curing days. However, leave soffit forms and shores in place until concrete has reached the specified 28-day strength, unless directed otherwise by the Engineer.

B. Cure formed surfaces not requiring rub-finishing by leaving forms in place for the full curing period. Keep wood forms wet during the curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound is applied.

#### C. Rubbed Finish:

- 1) At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging the surface.
- 2) After rub-finish operation are complete, continue curing formed surfaces by using either approved curing compounds or moist cotton mats until normal curing period is complete.
- D. Unformed Surfaces: Cure by membrane curing compound method.
  - 1) After concrete has received a final finish and surplus water sheen has disappeared, immediately seal surface with a uniform coating of approved curing compound, applied at the rate of coverage recommended by the manufacturer or as directed by the Engineer. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of the compound.
  - 2) Thoroughly agitate the compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.
  - 3) Do not apply compound to a dry surface. If concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or if rain falls on a newly coated surface before film has dried sufficiently to resist damage, apply an additional coat of compound at the specified rate of coverage.

## 3.09 REMOVAL OF FORMS AND SHORING

- A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubfinish when concrete has aged for the required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.
- B. Leave soffit forms and shores in place until concrete has reached the specified 28-day strength, unless directed otherwise by the Engineer.

## 3.10 DEFECTIVE WORK

A. Immediately repair any defective work discovered after forms have been removed. If concrete surface is bulged, uneven, or shows excess honeycombing or form

marks which cannot be repaired satisfactorily through patching, remove and replace the entire section.

#### 3.11 FINISHING

- A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use a stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with the surface.
- B. Apply an appropriate finish to exposed surfaces of formed concrete to match existing finish.

## 3.12 FIELD QUALITY CONTROL

- A. Unless otherwise directed by the Engineer, the following minimum testing of concrete is required. Initial concrete testing services by a testing laboratory shall be paid by the OWNER per Section 01410, retesting of failed areas will be at the expense of the CONTRACTOR. Testing shall be performed by qualified individuals employed by an approved independent testing agency, and conform to the requirements of ASTM C1077.
  - 1) Take concrete samples in accordance with ASTM C172.
  - 2) Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test the specimens in accordance with ASTM C31 and ASTM C39.
  - 3) When taking compression test specimens, test each sample for slump according to ASTM C143, for temperature according to ASTM C1064, for air content according ASTM C231, and for unit weight according to ASTM C138.
  - 4) Inspect, sample and test concrete in accordance with ASTM C94, Section 13, 14, and 15, and ACI 311-5R.
- B. Test cores shall conform to ASTM C42.
- C. When Type III cement is used in concrete, the specified 7-day and 28-day compressive strengths shall be applicable at 3 and 7 days, respectively.
- D. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. If additionally curing fails to produce the required strength, strengthening or replacement or portions of structure which fail to develop required strength may be required by the Engineer, at no additional cost to the Owner.

#### 3.13 PROTECTION

A. Protect concrete against damage until final acceptance.

- B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide such protection while the concrete is still plastic, and whenever such precipitation is imminent or occurring.
- C. Do not backfill around concrete structures or subject them to design loadings until all components of the structure needed to resist the loading are complete and have reached the specified 28-day compressive strength, except as authorized otherwise by the Engineer.

## 3.14 MISCELLANEOUS

A. All thrust blocking shall have 20-mil polypropelene plastic sheeting between concrete and pipe/fitting.

## PART 4: MEASUREMENT AND PAYMENT

A. Except as noted, work performed and the materials furnished for this item as indicated will not be measured for payment but will be considered subsidiary to other related items of work. Except as noted below no separate payment shall be made for concrete for utility construction.

**END OF SECTION 03305** 

#### SECTION 05001

#### STEEL & CONCRETE STRUCTURES

PART 1: GENERAL

The following specifications from the 2004 Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges as currently amended shall govern construction of steel and concrete structures:

Item 420. Concrete Structures Item 441. Steel Structures

## PART 2: CONTRACTOR RESPONSIBILITIES

- A. Execute all work as defined in the structural plans and specifications.
- B. Coordinate valve closures with the OWNER. Arrange for the securing of any necessary permits not obtained by the OWNER and pay for the same.
- C. The OWNER has right of first refusal of any structural materials removed from the job site (including salvageable materials). If the OWNER rejects the materials, then they are the property of the Contractor. Dispose of removed material off the right-of-way in accordance with federal, state, and local regulations.

PART 3: (NOT USED)

## PART 4: MEASUREMENT AND PAYMENT

A. Work performed and materials furnished in accordance with Item 420 & 441 shall be paid for at the unit price bid for the various structural elements as shown on the plans. This price is full compensation for furnishing, installing, preparing, cleaning and removal (as required) in completion of the work including equipment, labor, tools and incidentals.

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#### **PART 1: GENERAL**

#### 1.1 Scope of Work

This specification shall be used for surface preparation and coating of the City of Leander San Gabriel 1.25MG Elevated Storage Tank and associated piping and mechanical items.

#### 1.2 Related Work

D. 13210

A.	01300	Submittals
B.	02640	Buried Valves, Hydrants, and Appurtenances
C.	05001	Steel and Concrete Structures

E. Division 16 Electrical

F. Other related work as may be designated or called for on the design DRAWINGS and/or other related TECHNICAL SPECIFICATIONS.

Composite Elevated Water Storage Tank

#### 1.3 Definitions

A. Solvent Cleaning SSPC-SP 1 is defined as; solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces. It is intended that solvent cleaning be used prior to the application of paint and in conjunction with surface preparation methods specified for the removal of rust, mill scale, or paint.

- B. Power Tool Cleaning SSPC-SP 3 is defined as; Power tool cleaning is a method of preparing steel surfaces by the use of power assisted hand tools. Power tool cleaning removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.
- C. Commercial Blast Cleaning SSPC-SP 6, NACE 3 is defined as; A commercial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter. Random staining shall be limited to no more than thirty-three percent (33%) of each unit area of surface (approximately 5,800 mm² [9.0 in.²]) (i.e., a square 76 mm x 76 mm [3.0 in. x 3.0 in.]) and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating.
- D. Near White Blast Cleaning SSPC-SP 10, NACE 2 is defined as; A near-white metal blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter. Random staining shall be limited to no more than five percent (5%) of each unit area of surface (approximately 5,800 mm $^2$  [9.0 in. $^2$ ] (i.e., a square 76 mm x 76 mm [3.0 in. x 3.0 in.]), and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating.
- E. Power Tool Cleaning to Bare Metal SSPC-SP 11 is defined as; a steel surface cleaned with power tools to bare metal, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, rust, paint, oxides, mill scale, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted.
- F. Solvent Cleaning NAPF 500-03-01 is defined as; Solvent cleansing is a method which shall result in the surface being free of all oil, small deposits of asphalt paint, grease, soil, drawing and cutting compounds and other soluble contaminants from iron surfaces. It is intended that solvent cleaning,

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when necessary, be used prior to the application of special coating/lining and in conjunction with surface preparation methods specified for the removal of rust, annealing oxide, or mold coating

- G. Hand Tool Cleaning NAPF 500-03-02 is defined as; Hand tool cleaning is a method of preparing iron surfaces by the use of non-power hand tools which shall result in the surface being free of all loose annealing oxide, loose rust, loose mold coating and other loose detrimental foreign matter. It is not intended that adherent annealing oxide, old coating and rust be removed by this process. Annealing oxide, mold coating, and rust are considered adherent if they cannot be removed by lifting with a dull putty knife. All asphalt paint must be removed prior to hand tool cleaning.
- H. Power Tool Cleaning NAPF 500-03-03 is defined as; Power tool cleaning is a method of preparing iron surfaces by the use of power assisted hand tools which shall result in the surface being free of all loose annealing oxide, loose rust, loose old coating and other loose detrimental foreign matter. It is not intended that adherent annealing oxide, old coating and rust be removed by this process. Annealing oxide, mold coating, and rust are considered adherent if they cannot be removed by lifting with a dull putty knife. All asphalt paint must be removed prior to power tool cleaning.
- I. Abrasive Blast Cleaning of Ductile Iron Pipe NAPF 500-03-04 is defined as; Abrasive Blast Cleaning External Pipe Surfaces is a method of preparing the exterior of ductile iron pipe surfaces which, when viewed without magnification, shall result in the surface being free of all visible dirt, dust, loose annealing oxide, loose rust, loose old coating and other foreign matter. All oils, small deposits of asphalt paint and grease shall have been removed by solvent cleaning (see NAPF 500-03-01). After the entire surface to be coated is struck by the blast media, tightly adherent annealing oxide, mold coating and rust staining may remain on the surface provided they cannot be removed by lifting with a dull putty knife.
- J. Abrasive Blast Cleaning Cast Ductile Iron Fittings NAPF 500-03-05. Internal and External Surfaces is defined as; Abrasive blast cleaning is a method of preparing the interior and exterior of cast ductile iron fittings surfaces which, when viewed without magnification, shall result in the surface being free of all visible dirt, dust, loose annealing oxide, loose rust, loose old coating and other foreign matter. All oils, small deposits of asphalt paint and grease shall have been removed by solvent cleaning (see NAPF 500-03-01). Four degrees of abrasive blast cleaning for fittings are available, depending on the type of service for which the fitting is intended and upon the type of coating/lining specified.
- 1. Ductile Iron Fitting Blast Clean #1 No staining may remain on the surface after abrasive blast cleaning. This is the only method recommended for fittings previously coated with asphaltic paint.
- 2. Ductile Iron Fitting Blast Clean #2 In addition to the above general description, no more than 5% staining may remain on the surface after abrasive blast cleaning. Staining may consist of light shadows, rust stains, oxide stains or stains from previously applied coatings (provided the coating is not asphaltic).
- 3. Ductile Iron Fitting Blast Clean #3 In addition to the above general description, no more than 33% staining may remain on the surface after abrasive blast cleaning. Staining may consist of light shadows, rust stains, oxide stains or stains from previously applied coatings (provided the coating is not asphaltic).
- 4. Ductile Iron Fitting Blast Clean #4 In addition to the above general description, no limit is placed on the staining which may remain on the surface after abrasive blast cleaning provided it is tightly adherent. Staining may consist of light shadows, rust stains, oxide stains or stains from previously applied coatings (provided the coating is not asphaltic).
- K. The terms "coat, coating, lining, re-coat, re-coating and over coating" are synonymous and refer to the protective coatings specified herein.

L. Lining is defined as the tank inside and pipe inside coating.

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- M. The high water level in the tank is defined as; the top of the overflow structure.
- N. Outside air shall refer to the ambient air outside the tank.
- O. Inside air shall refer to the ambient air inside the tank.
- P. Process air shall refer to the air properties coming directly out of a dehumidification (DH) unit.
- Q. CONTRACTOR'S Inspector is defined as; the duly designated person who acts for, and on behalf of, the contractor on all inspection, testing and quality matters within the scope of the contract documents.
- R. OWNER'S Representative is defined as; the duly designated person who acts for, and on behalf of, the OWNER or Engineer on all observation, testing and quality matters within the scope of the contract documents.

#### 1.4 Applicable Standards and Codes

**ASTM D 520** 

A. The CONTRACTOR shall adhere to the Standards and Codes for work associated with Coating and Recoating as published by the following organizations. In the event there is a conflict between these Specifications and the Standards, and Codes, these Specifications shall govern. The OWNER'S decision shall be final regarding interpretation and/or conflict resolution between these Specifications and the referenced Standards and Codes. The latest revisions of the referenced Standards and Codes shall be used.

## 1. ANSI (American National Standards Institute)

ANSI/ASC 29.4Exhaust Systems

Abrasive Blasting Operations - Ventilation and Safe Practice

Standard Specifications for Zinc Dust Pigment (if Zinc

Nonconductive Protective Coating on Metallic Substrates

ANSI/NSF, Standard 61/600 Drinking Water Components

## 2. ASTM (American Society for Testing and Materials)

ACTIVID 020	Pigmented Coating is used)
ASTM D 4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D 4285	Standard Test Method of Indicating Oil and Water in Compressed Air
ASTM E 337	Standard Practice Test Method for Measuring Humidity with a Psychrometer
ASTM E 84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM D 2200	Standard Pictorial Surface Preparation Standards for Painted Steel Surfaces
ASTM D 4541	Standard Method for Pull-Off Strength of Coatings Testing Adhesion of Applied Coating Using Portable adhesion Tester
ASTM D 5162	Standard Practice for Discontinuity (Holiday) Testing of

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#### 3. AWWA (American Water Works Association)

AWWA D 100 Welded Steel Tanks for Water Storage

AWWA D 102 Coating Steel Water Storage Tanks

AWWA C 652 Disinfection of Water Storage Facilities

AWWA M42 Standard for Steel Water-Storage Tanks

#### 4. Consumer Product Safety Act, Part 1303

#### 5. EPA (Environmental Protection Agency)

Regulations found under 40CFR216 Subpart B-Criteria for identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste

## 6. AMPP Association for Materials Protection and Performance (formerly NACE International)

NACE Publication TPC2 Lining and Coating for Immersion Service: Chapter 1 Safety,

Chapter 2 Surface Preparation, Chapter 3 Curing, and

Chapter 4 Inspection

NACE Standard SP0178 Standard Recommended Practice - Fabrication Details,

Surface Finish Requirements and Proper Design Considerations for Tanks and Vessels to be Lined for

Immersion Service

NACE Standard SP0188 Standard Recommended Practice - Discontinuity (Holiday)

Testing of Protective Coatings on Conductive Substrates

NACE Standard RP0287 Field Measurement of Surface Profile of Abrasive Blast -

Cleaned Steel Surface Using a Replica Tape

NACE Standard RP0288 Standard Recommended Practice, Inspection of Linings on

Steel and Concrete

#### 7. NAPF (National Association of Pipe Fabricators)

NAPF 500-03-01 Solvent Cleaning

NAPF 500-03-02 Hand Tool Cleaning

NAPF 500-03-03 Power Tool Cleaning

NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe

NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings

## 8. OSHA (Occupational Safety & Health Administration)

1915.35 Standards - 29CFR Painting

# 9. AMPP Association for Materials Protection and Performance (formerly SSPC The Society for Protective Coatings)

SSPC-VIS 1-12 Visual Standards for Abrasive Blasted Steel Surfaces

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SSPC-VIS 3-04 SSPC Volume 1	Visual Standard for Power and Hand – Tool Cleaned Steel Good Painting Practices
SSPC Volume 2	Systems and Specifications including but not limited to the following:
SSPC-SP 1	Solvent Cleaning
SSPC-SP 2	Hand Tool Cleaning
SSPC-SP 3	Power Tool Cleaning
SSPC-SP 11	Power Tool Cleaning to Bare Metal
SSPC-PA 1	Shop, Field and Maintenance Painting
SSPC-PA 2	Measurement of Dry Film Thickness with Magnetic Gages
SSPC-PA 3	Guide to Safety in Paint Application
SSPC-Guide 6	Guide for Coating Debris Generated During Paint Removal Operations
SSPC-Guide 12	Guide for Illumination of Industrial Painting

#### 10. SSPC/NACE Joint Standards

SSPC-SP 5/NACE 1	White Metal Blast Cleaning
SSPC-SP 10/NACE 2	Near White Metal Blast Cleaning
SSPC-SP 6/NACE 3	Commercial Blast Cleaning
SSPC-SP 7/NACE 4	Brush-Off Blast Cleaning

#### 11. TCEQ (Texas Commission on Environmental Quality)

Division 1: Emissions Events and Scheduled Maintenance, Startup, and Shut Down Activities Regulation I, Control of Air Pollution and Visible Emissions from Particulate Matter, Standard 31

Division 3: Abrasive Blasting of Water Storage Tanks Performed by Portable Operations 111.131, 111.133, 111.135, 111.137, and 111.139

#### **Quality Assurance** 1.5

A. The CONTRACTOR shall hold current NACE International Institute Contractor Accredited Program Certification AS-1 F (NIICAP AS-1 F) or SSPC-QP 1 Certification (QP 1 Certification). This Certification shall remain valid for the duration of the project. All documents required by the NIICAP AS-1 F or QP 1 Certification shall be on site from the start of the project and must remain on site to the end of the project. The CONTRACTOR shall adhere to all of the requirements of its NIICAP AS-1 F or QP 1 Certification Program. This requirement shall not relieve the CONTRACTOR from adhering to all other requirements in these Specifications. The CONTRACTOR'S NIICAP AS-1 F or QP 1 Certification documents shall be available for review by the OWNER and/or the OWNER'S Representative(s) at any time. Should the CONTRACTOR'S Certification become voided during the project the CONTRACTOR shall notify the OWNER and/or the OWNER'S Representative immediately. The OWNER reserves the right to stop the CONTRACTOR'S work on the project if the CONTRACTOR'S NIICAP AS-1 F or QP 1 Certification becomes voided during the project. Contract time will continue even if the CONTRACTOR'S work is stopped.

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- B. The CONTRACTOR shall submit information regarding their Company and Superintendent's experience in water tank coating and lining and application over the past five (5) years. Information to be submitted shall follow the requirements in the "Qualification Statement", **Section 00200**, **Instructions to Bidders.**
- C. The CONTRACTOR and the CONTRACTOR'S painting technicians that will be responsible for application of one hundred percent (100%) solids coatings on this project shall be trained and certified by the Coating Manufacturer for application of the 100% solids coatings. Training and Certification shall be performed at the project site in the presence of the OWNER'S Representative(s). The painting technician(s) shall hold a current certification card for application of the 100% solids coatings. This card shall be made available for review upon request by the OWNER and/or the OWNER'S Representative(s) at any time. The certified painting technicians shall demonstrate their proficiency in applications of 100% solids coatings/linings on "mockups" (similar to that of the tank inside roof surfaces) at the project prior to application of the lining on the surfaces of the tank.
- D. The OWNER and/or the OWNER'S Representative(s) reserves the right to disqualify the CONTRACTOR'S painting technician(s) for lack of proficiency in application of any of the coatings and/or linings for this project.
- E. The following Coating Manufacturers are approved for this project.
- 1. Carboline Company, Inc. (Carboline)
- 2. International Paint (International)
- 3. PPG Protective and Marine Coatings (PPG)
- 4. Sherwin Williams (SW)
- 5. Tnemec Coatings (Tank Exterior Coating System Only)
- F. All coatings and caulking materials shall be free of heavy metals concentrations such as Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium and Silver, that would require abatement as a hazardous material. All products used on the inside wet surfaces shall be certified by the National Sanitation Foundation (NSF), Standard 61/600, for direct contact with potable water. All coatings shall be applied in strict conformance with the Coating Manufacturer's published specifications and with this Specification.
- G. The inside wet surfaces lining for the San Gabriel 1.25MG Elevated Storage Tank shall be 100% solids elastomeric material. Therefore, the coating for the outside dry surfaces may be supplied by an approved Manufacturer different from the approved Manufacturer for the inside wet surfaces lining. **See Part 2: LINING AND COATING SCHEDULE** for coatings specified for the San Gabriel 1.25MG Elevated Storage Tank.
- H. All materials shall be delivered to the job site in original sealed containers with the date of manufacture and batch number stamped thereon by the Coating Manufacturer. The batch numbers and dates of manufacture shall be clearly identifiable to the OWNER and/or the OWNER'S Representatives. Materials shall be subject to random observations by the OWNER and/or the OWNER'S Representative(s).
- I. No coating shall be used which has an expired shelf life or pot life.
- J. All coating material containers shall be properly stored for protection from freezing, moisture, excessive heat, outside adulteration and vandalism. Storage conditions shall be in compliance with the Coating Manufacturer's requirements. Coatings that have been damaged due to exposure to the elements or from any other source shall not be applied to the surfaces of the tank and shall be removed from the site. Damaged coatings shall be replaced with coatings for which submittals have been received and that are in compliance with project specifications.

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- K. No coating submitted or used on this project shall have a VOC (volatile organic content) in excess of 335.5 grams/liter or 2.8 lbs./gal.
- L. Since the time period to complete this project is critical and the work may occur during potentially low temperature conditions, the CONTRACTOR shall submit inside and outside coatings that can be applied and continue to cure to 40 degrees Fahrenheit (F) air and steel temperatures. Maximum or minimum temperature for air or surface in the published recommendations of the Coating Manufacturer shall not be exceeded during the application or the curing time.
- M. CONTRACTOR shall make known to the OWNER upon discovery, any conflicts between Specifications and Coating Manufacturer's product information/application literature.

#### 1.6 Submittals

- A. All submittals are due prior to order or delivery of materials to the project site. The CONTRACTOR shall provide a Submittal Schedule for all submittals for the project. Submittals shall be submitted as required by **Section 01300**, **Submittals** of the Project Manual. Following is a list of submittals that shall be submitted to the OWNER for review at the pre-construction conference.
- 1. A list of the quantities, types, and descriptions of all coatings to be used for each part of the project. No coatings, linings or caulk shall be shipped/delivered to the site until the OWNER's Representative reviews the list and writes a response for the list.
- 2. Coating Manufacturer's SAMPLE WARRANTY with all of the information required and same wording as in the SAMPLE WARRANTY in **Part 1, 1.7 Manufacturer's Coating Warranty, Paragraphs A.1 and B.1.** Modification of the wording will not be approved or accepted.
- 3. Coating Manufacturer's color selection literature for color selection by the OWNER for each and all coating materials, and caulk.
- 4. Lining and coating data sheets complete with a graduated scale or curve, produced by the Coating Manufacturer, with curing characteristics and recommendations regarding complete coating curing. The data sheets and scales or curves shall include specific recoat and cure times over a wide range of temperatures. This data shall include adjustments for weather conditions.
- 5. Coating data sheets and quality control reports for materials, pipes, valves, etc. that are shipped to the project with shop applied coatings. The shop applied coatings shall be compatible with the coatings that will be that are listed in **Part 2: LINING AND COATING SCHEDULE**.
- 6. Coating Manufacturer's Product Information and application instructions. Product Information shall include the following:
  - a. Manufacturer's published instructions for applying all proposed coatings, including MSDS for all coating and caulk products. Instructions for all proposed coating and caulk products shall include and conform to the following:
    - I. Instructions shall have been written and published by the Coating Manufacturer for the purpose and with the intent of giving complete instructions for the application of the proposed coating in the geographical location of the project and for the conditions in this Specification.
    - II. All limitations, precautions and requirements that may adversely affect the coating, which may cause unsatisfactory results after the application or that may cause the coating not to serve the purpose for which it was intended, shall be clearly and completely stated in the instructions. Limitations and requirements shall include, but are not necessarily limited to the following:
      - i. Surface preparation.
      - ii. Method (s) of application.

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- iii. Thickness of each coat (maximum and minimum).
- iv. Drying and curing time of each coat, including primer.
- v. Time (minimum and maximum) allowed between coats.
- vi. Thinner and use of thinner.
- vii. Proper mixing of coating before application.
- viii. Weather limitations during and after application (temperature and humidity, time weighted).
- ix. Physical properties of coating, including percent solids content by volume.
- x. Equipment settings (air cap, fluid tip, equipment pressure settings, etc.
- xi. Pot life at various temperatures and humidities.
- 7. Coating Manufacturer's written recommended repair procedures. These procedures shall include, but not be limited to the following:
  - a. Written detailed procedures for all surface preparation and application of coating, including touch-up procedures.
  - b. Method of power tool cleaning.
- 8. The materials to be used for protection of outside surfaces, and that allow for recovery and disposal of paint scraps and blast media.
- 9. Evidence of notification of the appropriate office of the Texas Commission on Environmental Quality (TCEQ) prior to abrasive blasting.
- 10. Method of emission containment and emission monitoring plan. The method of emission containment must meet the requirements of the EPA, OSHA, TCEQ, local, state and federal regulations and must include sampling parameters, methods, intervals, durations, action levels and reporting procedures. If the CONTRACTOR plans to "keep emissions within the confines of the tank property", the CONTRACTOR shall provide written details of how this will be accomplished. If the CONTRACTOR is not successful in "keeping emissions within the confines of the tank property", the CONTRACTOR shall provide containment shrouding of the tank, valves and other appurtenances during all abrasive blasting and spray application of coatings. Prior to installing containment shrouding, structural details of the containment shrouding sealed by a Professional Engineer Licensed in the State of Texas and that follow the requirements of Class 2A, Type A2 of SSPC Guide 6, shall be submitted for review and approval. All costs associated with installation, maintenance and removal of containment shrouding shall be borne by the CONTRACTOR and shall not be at a contract cost increase.
- 11. A written plan for detailing the methods and procedures for the proper testing, handling, storage, manifesting and disposal of all wastes. The removal and disposal plan shall meet the requirements of the EPA, OSHA, TCEQ, local, state and federal regulations.
- 12. The proposed dehumidification and ventilation configuration for the inside of the tank, shall include the following information, but not be limited to:
  - a. Calculations for dehumidification and ventilation requirements.
  - b. Fans and their locations.
  - c. Dimensions of equipment.
  - d. Maximum capacities of equipment.
  - e. Emission control devices.
  - f. Method of filtration of exhausted tank air.
  - g. EMD-continuous electronic monitoring device.

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- 13. Methods and materials for attaching temporary covers over openings in the tank shall be submitted at the pre-construction conference or prior to any work beginning on the tank.
- 14. Methods of recovering blast material from the inside of pipes entering and exiting the tank.
- 15. Method of preventing workers or any other person from falling into open pipes or any other openings inside or outside the tank.
- 16. A plan to protect the CONTRACTOR'S Worker's Safety and Health. This plan shall be in accordance with the requirements of all applicable OSHA regulations.
- 17. Information for the CONTRACTOR'S competent person(s) that will to be on site at all times during construction. The competent person must meet OSHA requirements for a competent person. The submittal must contain documentation for the competent person(s) that demonstrates adequate training and certification to meet OSHA requirements.
- B. Following is a list of other submittals required for the project that may be submitted to the OWNER'S Representative for review after the pre-construction conference. CONTRACTOR work that begins before the OWNER'S Representative has provided a reviewed status for a specific submittal will be performed at the CONTRACTOR'S own risk.
- 1. Coating Manifest Within 48 hours of coating delivery to the job site, the CONTRACTOR shall record the batch number and dates of manufacture stamped on each coating and reducer container and submit a typed list to the OWNER'S Representative. Minimum information required is listed below:
  - a. Date of delivery to job site.
  - b. Name and signature of Superintendent recording the data.
  - c. List of batch numbers including corresponding coating identification, color, date of manufacture, shelf life and volume of each container.
  - d. Quantity in gallons of each coating and reducer delivered to the project. List shall include a running total of the quantities of the materials delivered.
- 2. Provide technical data from Coating Manufacturer for equipment to control inside surface conditions. Coating Manufacturer shall approve use of such equipment in writing. Submission of this data is to be received a minimum of fourteen (14) days before inside surface preparation or coating is to be applied.
- 3. Coatings mock-ups shall be provided as a submittal and prior to any surface preparation on the tank and remain on site until completion. Sample and surfaces of each coat must be of adequate size to allow for the OWNER'S Representatives to perform adhesion and chemical tests on each coat to ensure conformance with these Specifications and Manufacturer's requirements. The mockup shall be exposed to the same environment that the prepared and coated surfaces of the tank are exposed to. The minimum 2' X 2' mock-ups shall include the following:
  - a. Tank Inside mockup:
    - I. Approved sample of SSPC-SP 10 Near White Metal Blast Cleaned Steel protected with a clear spray varnish.
    - II. Specified inside lining system showing each coat.
  - b. Tank Outside mockup:
    - I. Approved sample of SSPC-SP 6 Commercial Blast Cleaned Steel protected with a clear spray varnish.

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- II. Specified outside coating system showing each coat.
- 4. Provide information for recyclable abrasives for abrasive blasting steel surfaces. Information shall also be provided for written protective measures that stipulate specific procedures to be followed to protect all workers and all other persons on site from exposure to its use as required by Federal, State and other governing authorities having jurisdiction. Blasting abrasives or other products that produce Free Silica and abrasive manufactured from Copper Slag are prohibited from use on the project.
- 5. MSDS and certification from the abrasive supplier stating that the abrasive to be supplied satisfies the requirements of this specification.
- 6. Daily recordings of tank inside air quality including carbon monoxide. CONTRACTOR shall provide calibrated air quality monitoring equipment, with continuous readings. Copies of the readings shall be submitted to the OWNER'S Representative with the CONTRACTOR'S daily inspection reports each day the Representative. The reports shall include environmental condition readings.
- 7. Current calibration report for the air quality monitoring equipment.
- 8. Not Used.
- 9. Thirty (30) days prior to disinfection of tank submit data and MSDS for fresh calcium hypochlorite and quantity required for disinfection of the tank.
- 10. Vouchers for maintenance coatings and linings as specified in PART 1: GENERAL, 1.8 Maintenance Coatings and Linings of these Specifications.
- 11. Caulk for flanges and dresser sleeve joints on pipes and valves, pipes entering and exiting the tank pedestal as specified in **Part 2: LINING AND COATING SCHEDULE, 2.2 Grout and Caulk Schedule** of these Specifications.
- 12. For shop and/or manufacturer applied coatings, all quality control reports for surface preparation and coating applications. Shop or manufacturer applied primer coatings shall be compatible with the coatings specified in **Part 2: LINING AND COATING SCHEDULE** as applicable.
- 13. Automated wind speed and direction monitoring equipment.
- 14. Waste management plan.
- 15. Any other submittal requested by OWNER or necessary to clarify work by CONTRACTOR.

#### 1.7 Coating Manufacturer's Warranty

## A. Inside of Tank:

- 1. Coating Manufacturer and CONTRACTOR shall issue to the OWNER a fifteen (15) year warranty for the lining applied on the inside of the tank. The Manufacturer's and CONTRACTOR'S Representatives shall sign the Coating Manufacturer's warranty stating that the lining was applied in accordance with these Specifications and the Manufacturer's recommendations. This warranty shall be issued at Substantial Completion of the project. A Sample of this warranty shall be submitted as required in PART 1: GENERAL, 1.6 Submittals, Paragraph A.2 of these Specifications.
- B. Outside of Tank:
- 1. Coating Manufacturer and CONTRACTOR shall issue to the OWNER a ten (10) year warranty for the coating applied on the outside of the tank. The Manufacturer's CONTRACTOR'S Representatives shall sign the Coating Manufacturer's warranty stating that the lining was applied in accordance with these Specifications and the Manufacturer's recommendations. This warranty shall be issued at Substantial Completion of the project. A Sample of this warranty shall be submitted as required in **PART**

- **1: GENERAL, 1.6 Submittals, Paragraph A.2** of these Specifications. Note: if the ALT OD 1 coating system in the Part 2 Paint Schedule is chosen by the OWNER, the ten (10) year warranty will not be applicable. However, the warranty below will apply:
  - a. CONTRACTOR shall issue to the OWNER a two (2) year warranty for coating application workmanship for the tank exterior and piping interior and exiting the pedestal. The CONTRACTOR'S Maintenance Bond may be used to assure this work, but will require Surety's acknowledgement in writing prior to commencement of coating application on the project.
  - b. Coating Manufacturer shall issue to the OWNER a two (2) year warranty for coatings for the tank exterior and piping interior and exiting the pedestal. Coating Manufacturer shall provide OWNER in writing prior to commencement of coating application on the project, fiscal surety assuring coatings.
- C. The following is a SAMPLE COATING MANUFACTURER'S WARRANTY format for lining and coating systems applied to the inside and outside of the tank. All information, conditions and wording in the warranty are the requirements of the OWNER and will be required for this project. Modification of the wording will not be approved or accepted.

#### **SAMPLE**

## **COATING MANUFACTURER'S WARRANTY**

<u>Coating Supplier Logo, Address and Contact Information</u>

Date

PROJECT NAME: San Gabriel Elevated Storage Tank Project - 1.25MG

**OWNER**: City of Leander

LOCATION: San Gabriel Blvd, Leander, TX

**CONTRACTOR**: Paint Contractor

1. COATING SUPPLIER NAME INSIDE COATING SYSTEM (The "SYSTE
--

a. Surface Preparation: SSPC-SP 10 degree of cleanliness and obtain a 3.5 mil minimum angular anchor profile.

b. Coating Products: \_\_\_\_\_ @ 30 mils minimum DFT when measured in accordance with SSPC-PA2.

## 2. INSIDE WET SURFACE WARRANTY:

Coating Supplier Name, hereinafter called "Coating Supplier Name", warrants that the Coating Products were not defectively manufactured and therefore the System, if applied in accordance with Coating Supplier Name's specifications, will prevent delamination and corrosion (collectively, "Coating Problems") of the surface on which the System is applied of more than one percent (1.0%) per year for fifteen (15) years from the date of application on the inside of the tank.

## 3. COATING SUPPLIER NAME OUTSIDE COATING SYSTEM (The "SYSTEM")

a. Surface Preparation: SSPC-SP 6 degree of cleanliness and obtain a 2.0 mil minimum angular anchor profile.

b. Coating Products:	@ 8 mils minimum DFT when measured in
accordance with SSPC-PA2.	

## 4. OUTSIDE DRY SURFACE WARRANTY:

Coating Supplier Name, hereinafter called "Coating Supplier Name", warrants that the Coating Products

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were not defectively manufactured and therefore the System, if applied in accordance with <u>Coating Supplier Name</u> specifications, will prevent blistering, cracking or alligatoring and corrosion; (collectively, "Coating Problems") of the surface on which the System is applied of more than one percent (1.0%) per year for ten (10) years from the date of application. The System will also not have a change of color of more than 12 CIE LAB units (measured as 12 Delta E) after ten (10) years. The System will also not have a loss of gloss of more than 30 units after ten (10) years. Gloss to be measured by gloss meter in accordance with ASTM D523-89 w/60 geometry. The obligation of <u>Coating Supplier Name</u> under this warranty is limited as set forth below. The warranty period will not be extended for any event or occurrence including, but not limited to, repairs.

#### 5. CONDITIONS TO BE CONSIDERED AS NORMAL MAINTENANCE:

During each year of this warranty, Coating Problems not greater than the allowable percentage set forth in Paragraph 2 and 4 or other coating related issues related to the project shall be considered normal maintenance, correction of which shall be the responsibility of the OWNER.

#### 6. APPLICATION OF SYSTEM:

Surface preparation and application of the System to all coated and related surfaces must be done in strict accordance with Coating Supplier Name's then current Application Instructions of Coating Supplier Name.

#### 7. CONDITIONS:

This warranty is conditioned upon and will be invalidated by failure to strictly comply with the following conditions:

- a) A PRE-JOB conference, which was attended by the OWNER, the OWNER's Representative, the site General CONTRACTOR, the selected Painting CONTRACTOR, and <u>Coating Supplier Name</u>, to ensure that all parties understood the written specification.
- b) Only Coating Supplier Name products, including thinners, were used as components of the System.
- c) The cure period required for the System was conformed to in all material respects with the optimum time, temperature and humidity stipulation of Coating Supplier Name as set forth in its Product Data Sheets.
- d) A <u>Coating Supplier Name</u> representative was permitted at all times requested, to observe all aspects of the surface preparation and system application work.
- e) The surface on which the System was applied was of a quality necessary for the System to provide the protection required.
- f) The CONTRACTOR has signed this warranty which confirms the surface has been prepared and the System has been applied in strict accordance with <u>Coating Supplier Name's</u> recommendations and Application Instructions.
- g) The OWNER has signed this warranty confirming that the work has been completed in accordance with the specifications of OWNER and has been accepted.
- h) <u>Coating Supplier Name</u> must be notified within thirty (30) days of the date Coating Problems are observed and must be afforded opportunities to inspect any such areas, at such times as <u>Coating Supplier Name</u> may reasonably request.
- i) <u>Coating Supplier Name</u> has received full and timely payment of all <u>Coating Supplier Name</u> invoices both for materials supplied to the project and for any services rendered by <u>Coating Supplier Name</u>.
- j) After a claim has been made, the complainant has notified <u>Coating Supplier Name</u> about the environment to which all areas covered by this warranty have been exposed since the initial application including surface treating, washing and cleaning procedures, heating cycles and other data to re-construct the services history of the project.

## 8. EXCLUSIONS:

In addition to limitations and exclusions set forth in other provisions, this warranty shall not apply to areas of Coating Problems which have resulted from damage during shipment or construction or from physical or mechanical abuse or from the failure to perform the normal maintenance, normal wear and tear, from welding, inside heating, or war, fire, explosion, catastrophe, or other acts of God, harmful chemicals, fuels or vapors, any event or service beyond a reasonable term of usage, or surface areas which because of their physical shape, characteristics or configuration, present special coverage difficulties.

#### 9. COATING SUPPLIER NAME'S OBLIGATIONS:

In the event the System does not provide the protection referred to in Paragraphs 2 or 4, as applicable to the systems, Coating Supplier Name's sole obligation shall be to provide coating for the area where the

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Coating Problems occurred, by providing such <u>Coating Supplier Name</u> coating materials for up to a period of fifteen (15) years for the Inside Coating System or ten (10) years for the Outside Coating System as may be necessary to correct the affected area, PROVIDED, HOWEVER, that <u>Coating Supplier Name</u> shall not be obligated to provide replacement coating materials having an aggregate volume in excess of the original quantity provided and initially applied. At such time, if any, as <u>Coating Supplier Name</u> shall have supplied replacement coating material(s) with an aggregate volume equal to one hundred percent (100%) of the total volume of the <u>Coating Supplier Name</u> coating materials initially applied, <u>Coating Supplier Name</u> obligation under this Warranty shall be deemed to have been completely fulfilled. Repairs performed under this Warranty shall neither extend the term of this Warranty nor affect the allowable percentage specified herein.

#### 10. LIMITATIONS OF COVERAGE:

This warranty constitutes the sole and exclusive warranty given by <u>Coating Supplier Name</u> with respect to the System; all warranties and obligations not expressly set forth herein are excluded. By way of illustration and not limitation, any and all liabilities and obligations for consequential and incidental damages, including, but not limited to, damages for injuries to persons or to property, or breach of contract, or breach of implied covenant of good faith and dealing, or negligence, or strict liability, or for labor costs, or material costs not specifically provided for herein, or for other costs of repair work, or for loss of use or time or revenues or profits, or for any claims by third parties are expressly excluded from this warranty.

## 11. ARBITRATION:

The parties hereto agree that all disputes and differences arising under this warranty shall be resolved by binding arbitration in Leander, Texas in accordance with the rules of the American Arbitration Association. The decision of the arbitrators shall be final. It may be enforced in any court having competent jurisdiction. The cost of arbitration shall be borne equally by the parties hereto.

#### 12. GOVERNING LAW:

This warranty shall be interpreted and construed under and in accordance with the laws of the State of Texas.

THIS WARRANTY IS THE SOLE WARRANTY AND CONSTITUTES THE EXCLUSIVE REMEDY OF CONTRACTOR AND OWNER IN CONNECTION WITH THE SYSTEMS.

THIS WARRANTY IS SUBJECT TO THE LIMITATIONS AND CONDITIONS DESCRIBED ABOVE AND SHALL NOT BE DEEMED TO INCLUDE ANY WARRANTY OF FITNESS OR MERCHANTABILITY WHETHER EXPRESSED OR IMPLIED, WHICH ARE HEREBY DISCLAIMED, AND COATING SUPPLIER NAME COMPANY SHALL HAVE

NO LIABILITY EXCEPT AS SPECIFICALLY EXPRESSED HEREIN.

THIS WARRANTY IS ISSUED TO THE OWNER ONLY AND IS NOT ASSIGNABLE OR TRANSFERABLE. PRESENTATION OF AN EXECUTED WARRANTY COPY TO <u>COATING SUPPLIER NAME</u> AT THE TIME OF CLAIM IS A CONDITION OF THIS WARRANTY.

THIS WARRANTY CONTAINS A BINDING ARBITRATION PROVISION WHICH MAY BE ENFORCED BY THE PARTIES.

	COATING SUPPLIER NAME
	BY:
	Date:
	Date:
uthorized CONTRACTOR Signature Vork performed in accordance with <u>Coating Supp</u>	<u>lier Name</u> recommendations)
	Date:

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Authorized OWNER Signature (Work accepted as applied)

#### **END SAMPLE COATING MANUFACTURER'S WARRANTY**

- D. Pipes for the Inside Base of the Pedestal:
- 1. CONTRACTOR shall issue to the OWNER a two (2) year warranty for coating application workmanship for the inside base of the pedestal. The CONTRACTOR'S Maintenance Bond may be used to assure this work, but will require Surety's acknowledgement in writing prior to commencement of coating application on the project.
- 2. Coating Manufacturer shall issue to the OWNER a two (2) year warranty for coatings for the inside base of the pedestal. Coating Manufacturer shall provide OWNER in writing prior to commencement of coating application on the project, fiscal surety assuring coatings.
- E. Warranty Work:
- 1. CONTRACTOR and Coating Manufacturer shall coordinate warranty work requested by OWNER at any time during warranty period. OWNER is only required to contact CONTRACTOR to initiate warranty work.

## 1.8 Maintenance Coatings and Linings

A. At the end of the project and before final payment, the CONTRACTOR shall provide the OWNER, Coating Manufacturer's or Coating Supplier's vouchers equivalent in value to five (5) one (1) gallon cans of each type and color of coating and or lining, primer, thinner, and other coatings used on the project, including multiple component materials. Upon request by OWNER, the coating and/or lining shall be delivered in unopened, typed-labeled cans (including color, batch number and manufacturer date), just as it comes from the Coating Manufacturer. If the Coating Manufacturer or Supplier does not package the material in one (1) gallon cans, and in the case of special colors, the coatings or lining may be delivered in new larger containers not to exceed five (5) gallons capacity, properly closed with typed, color, batch numbers and manufacture date. The Coating Manufacturer's directions for use and literature describing the coatings and/or lining shall also be furnished to the OWNER in three bound copies and a typed inventory list shall be furnished at the time of delivery. These vouchers shall remain valid for ten (10) years from date of issuance, date of issuance not to occur before Substantial Completion.

#### PART 2: LINING AND COATING SCHEDULE

2.1 IW - 01 Inside Wet Lining System, Tank Roof, Shell and Floor

One coat system (AWWA D102 Inside Lining (Coating) System No. 4) to be one of the following and of the same Manufacturer of all other coating products used on this project:

Coating: 100% Solids Elastomeric NSF 61/600 Coating

Carboline Reactamine 760 Polyurethane

International Polibrid 705 Elastomeric Polyurethane
PPG Amerthane 490 Elastomeric Polyurethane
Sherwin Williams Sherflex Poly-Cote 115 Polyurethane

Color: As required by OWNER

Coating System Thickness: 30 mils total dry film thickness

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Surface Preparation

All Surfaces: Near White Blast Cleaning per SSPC-SP 10, NACE 2. Shop applied holding

primer on all inside wet surfaces of tank shall be removed by abrasive blasting after tank construction and before application of the tank interior lining system. Existing and new weld profiles should conform to NACE SP0 178, Profile D or

better.

Surface Profile: Coating Manufacturer's requirement but not less than 3.5 mils.

Adhesion: The coating system shall have a minimum adhesion strength of no less than

seven hundred (700) psi, for each of ten (10) test as tested per ASTM D 4541

after 17 days cure at a minimum 40 degrees F.

Special Note 1: The CONTRACTOR and painting technician(s) responsible for application of

the 100% solids lining shall have a current certification from the Coating

Manufacturer for application of the 100% solids lining.

Special Note 2: The 100% solids lining System shall cover all edges, bridge all gaps, be

monolithic and shall be 100% Holiday free.

Special Note 3: All weld seams, gaps, edges, bolts and difficult areas to coat and line inside

the tank shall receive an initial spray applied stripe coat of the 100% solids lining just before application of the lining over the entire surface in the area being coated. As a result, all weld seams, gaps, edges, bolts and difficult areas

to coat and line shall receive a double layer of the lining.

Special Note 4: CONTRACTOR shall prevent dirt and debris from becoming adhered to the

surface or imbedded in the coatings during application and cure time. If dirt and debris become adhered to or embedded in the coating, the

CONTRACTOR shall remove the dirt and debris and recoat the area.

OD - 01 Outside Dry Coating System, Tank Roof and Shell, Includes Piping and Valves Entering and Exiting Base of Pedestal

Two-coat system (AWWA D102 Outside Coating System No. NA) to be one of the following and of the same Manufacturer of all other coating products used on this project:

Prime Coat: Organic Zinc Rich Primer (Minimum 80% Zinc by Weight)

@ 3.0 to 4.0 mils DFT

Carboline Carbozinc 859
International Paint Interzinc 52
PPG America 68HS
Sherwin Williams Corothane I GalVaPac

Silei Will Williams Coloulane i Galvar ac

Stripe Coat: Polysiloxane, High Gloss

Carboline Carboxane 2000
International Paint Interfine 979
PPG PSX 700

Sherwin-Williams Polysiloxane - XLE 80

Color: As approved by OWNER

Finish Coat: Polysiloxane, High Gloss @ 5.0 to 7.0 mils DFT

Carboline Carboxane 2000 International Paint Interfine 979

PPG PSX 700

Sherwin-Williams Polysiloxane - XLE 80

Color for Tank: As required by OWNER

Colors for Tank Logos: City Logo colors include Reflex Blue, PMS 5757, PMS 5767, PMS

581, PMS 5905, PMS 5945, PMS 117, and PMS 117 – 0 Tint

Coating System Thickness: 8 to 11 mils total dry film thickness.

3 mils minimum any single coating layer with exception of the prime

coat.

Surface Preparation

Carbon Steel: Weld seams and abrasions shall be SSPC-SP 6, NACE 3 Commercial Blast

Cleaned. Shop primed components that that are not coated with successive coats within the Coating Manufacturer's recommended recoat window and shop applied holding primer shall be "sweep blasted" in accordance with SSPC-SP 7 Brush-Off Blast Cleaning. Existing and new weld profiles should

conform to NACE SP0 178, Profile D or better.

Surface Preparation
Ductile Iron/Cast

Piping and Valves: NAPF 500-03-01, NAPF 500-03-04 and NAPF-03-05. Degree of Cleanliness,

Blast Clean #3.

Surface Profile: Coating Manufacturer's requirement but not less than two (2) mils.

Adhesion: The coating system shall have a minimum adhesion of no less than five

hundred (500 psi) for each of five (5) tests, as tested per ASTM D 4541 after

seventeen (17) days cure at minimum 40 degrees F.

Special Note 1: Stripe coat shall be applied to all welds, weld seams, and tack welds (new and

old), edges, bolts (with exception of hot-dipped galvanized bolts, nuts and washers), rivets, ladder rails and rungs (where required), seamed corners, joints of any kind and locations where brackets, lugs and other difficult to coat surfaces exist. Stripe coat on all welds and weld seams shall extend two (2) inches minimum above, below and beyond all welded sections. Stripe Coat

may be applied during application of finish coating.

Special Note 2: Multiple coats may be required to obtain desired appearance, recommended

dry film thickness and adequate hiding or coverage of the underlying coating.

Special Note 3: The logo and name shall be applied in accordance with the details. The two

(2) logos shall be field applied with ten (10) colors each, 24 feet high by 21.6 feet wide. The text, City of Leander, broken in into two (2) lines with a total height of 24 feet shall be field applied in the font selected by the OWNER. Dimensions are based on a 25.5 foot vertical tank wall, to be adjusted as necessary for differing tank wall heights. Logo to be centered vertically on tank

wall.

Special Note 4: Surfaces that are not to be prepared and coated including, but not limited to

hot-dipped galvanized bolts, nuts and washers, sight glasses, gages, name tags, ladders, conduits, and light fixtures shall be protected from surface preparation and coating operations. The CONTRACTOR shall be responsible

for damage to these items.

Special Note 5: Do not paint copper tubing and brass gate valves on sample and pressure

taps.

Special Note 6: Do not paint bolts in flange assembly for drain cam lock flange assembly at

outside base of pedestal. Bolts in flange assembly shall be hot-dipped galvanized and shall include hot-dipped galvanized flat washers under the bolt heads and nuts. Due to dis-similar metals in the flange and bolts assemblies,

dielectric isolation kits shall be installed for the bolt assemblies.

Special Note 7: The outside coating system shall be applied six (6) inches onto any stainless

steel materials that may be welded to the outside of the tank. The stopping point on the stainless steel surfaces that are to be coated shall be masked with tape that is the same as our equal to painter's tape, duct tape shall not be used. After application of the coating and the coating system has dried (not

cured) to a soft consistency the tape shall be removed.

Special Note 8: CONTRACTOR shall prevent dirt and debris from becoming adhered to the

surface or imbedded in the coatings during application and cure time. If dirt and debris become adhered to or embedded in the coating, the CONTRACTOR shall remove the dirt and debris and recoat the area.

OD - 02 Inside and Outside Dry Coating System, Access Tube and Bottom Side of Tank Bowl Floor Hatch

Three-coat system (AWWA D102 Outside Coating System No. NA / AWWA D102 Outside Coating System No. NA) to be one of the following and of the same Manufacturer of all other coating products used on this project:

Prime Coat: Organic Zinc Rich Primer (Minimum 80% Zinc by Weight)

@ 3.0 to 4.0 mils DFT

Carboline Carbozinc 859
International Paint Interzinc 52
PPG Amercoat 68HS
Sherwin-Williams Corothane I GalVaPac

Stripe Coat: Epoxy

Carboline Carboguard 60
International Paint Interseal 670HS
PPG Amerlock 400
Sherwin-Williams Macropoxy 646

Intermediate Coat: Epoxy @ 4.0 to 6.0 mils DFT

Carboline Carboguard 60
International Paint Interseal 670HS
PPG Amerlock 400

March 200

Sherwin-Williams Macropoxy 646

Finish Coat: Epoxy @ 4.0 to 6.0 mils DFT

Carboline Carboguard 60
International Paint Interseal 670HS
PPG Amerlock 400
Sherwin-Williams Macropoxy 646

Color: As required by OWNER

Coating System Thickness: 11 to 16 mils total dry film thickness

2 mils minimum any single coating layer

Surface Preparation

Carbon Steel: Weld seams and abrasions shall be SSPC-SP 6, NACE 3 Commercial Blast

Cleaned. Shop primed components that that are not coated with successive coats within the Coating Manufacturer's recommended recoat window and shop applied holding primer shall be "sweep blasted" in accordance with SSPC-SP 7 Brush-Off Blast Cleaning. Existing and new weld profiles should

conform to NACE SP0 178, Profile D or better.

Surface Profile: Coating Manufacturer's requirement but not less than 2 mils.

Adhesion: The coating system shall have a minimum adhesion of no less than 500 psi,

(average of five tests) as tested per ASTM D 4541 when applied to SSPC-SP 6 Commercial Blast Cleaned steel after 17 days cure at minimum 40 degrees

F.

Special Note 1: Stripe Coat on all weld seams, bolts, edges and difficult to coat areas may be

applied during application of the intermediate coating and/or finish coating.

Special Note 2: Surfaces that are not to be prepared and coated including, but not limited to

sight glasses, gages, name tags, concrete walls, gratings and support structures, ladders, conduits and light fixtures shall be protected from surface preparation and coating operations. The CONTRACTOR shall be responsible

for damage to these items.

Special Note 3: CONTRACTOR shall prevent dirt and debris from becoming adhered to the

surface or imbedded in the coatings during application and cure time. If dirt and debris become adhered to or embedded in the coating, the

CONTRACTOR shall remove the dirt and debris and recoat the area.

## OD - 03 Valves and Piping at the Inside Base of the Pedestal

Two-coat system (AWWA D102 Outside Coating System No. NA) to be one of the following and of the same Manufacturer of all other coating products used on this project:

Prime Coat: Penetrating Sealer @ 1.5 to 2.0 mils DFT (2mils DFT max) unless

otherwise noted

Carboline Rustbond Penetrating Sealer

International Paint Interbond 600 PPG Amerlock Sealer

Sherwin Williams Macropoxy 920 PrePrime

Spot Prime: Epoxy @ 3.0 to 5.0 Mils DFT

Carboline Carboguard 60
International Paint Interseal 670HS
PPG Amerlock 400

Sherwin Williams Macropoxy 646

Stripe Coat: Polyurethane, High Gloss @ 2.0 to 3.0 mils DFT

Carboline Carbothane 133 HG
International Paint Interthane 990V
PPG America 450H

Sherwin-Williams Hi-Solids Polyurethane

Colors: Multiple Colors As required by OWNER

Finish Coat: Polyurethane, High Gloss @ 2.0 to 3.0 mils DFT

Carboline Carbothane HG
International Paint PPG Interthane 990V
Americat 450H
Sherwin-Williams Hi-Solids Polyurethane

Colors: Multiple Colors As required by OWNER

Coating System Thickness: 6.5 to 10 mils total dry film thickness for pressure washed surfaces

9.5 to 14 mils total dry film thickness for power tool cleaned surfaces 3 mils minimum any single coating layer with exception of the prime

coat

Surface Preparation:

A. For factory or product manufacturer applied coatings such as enamels, oil alkyds or similar coatings: low pressure spray with a solution of water, chlorine bleach, biodegradable detergent and a TSP substitute. Before this solution dries, high pressure water jet at a minimum 3500psi with clean water to remove all bleach and cleaner from the surface. High pressure water jetting shall not remove tightly adhered coating. Prepare any rusted areas by NAPF 500-03-01 Solvent Cleaning, NAPF 500-03-02 Hand Tool Cleaning and NAPF 500-03-03 Power Tool cleaning with shrouding attached to the power tool.

B. For factory or product manufacturer applied coatings such as fusion bonded epoxy or similar coatings; abrade all surfaces of the coating or coatings to remove the gloss. Prepare any rusted areas by NAPF 500-03-01 Solvent Cleaning, NAPF 500-03-02 Hand Tool Cleaning and NAPF 500-03-03 Power Tool cleaning with shrouding attached to the power tool.

C. For factory or product manufacturer applied coatings such as bituminous or similar coating; remove the coating and prepare the surfaces with the NAPF 500-03-01, NAPF 500-03-04 and NAPF-03-05. Degree of Cleanliness, Blast Clean #3.

D. Existing weld profiles should conform to NACE RPO 178, Profile D or better.

Surface Profile: Manufacturer's requirement but not less than 2 mils for power tool cleaned.

Special Note 1: Stripe Coat on all bolts, edges and difficult to coat areas may be applied during

application of the intermediate coating and/or finish coating.

Special Note 2: Surfaces that are not to be prepared and coated including, but not limited to

pump motors, seals for pumps motors, sight glasses, gages and name tags shall be protected from surface preparation and coating operations. The

CONTRACTOR shall be responsible for damage to these items.

Special Note 3: CONTRACTOR shall prevent dirt and debris from becoming adhered to the

surface or imbedded in the coatings during application and cure time. If dirt and debris become adhered to or embedded in the coating, the

CONTRACTOR shall remove the dirt and debris and recoat the area.

## **ALTERNATIVE PART 2: LINING AND COATING SCHEDULE**

ALT OD - 01 Outside Dry Coating System, Tank Roof and Shell, Includes Piping and Valves Entering and Exiting Base of Pedestal

Three-coat system (AWWA D102 Outside Coating System No. NA) to be one of the following. Note: ALT OD - 01 includes coating products manufactured by Tnemec. If the CONTRACTOR

Section 09900

submits Tnemec coating products listed in ALT OD - 01 and if the OWNER approves use of the listed Tnemec products, those products may be used even though coating products from a different Manufacturer are being supplied for other areas of the tank:

Prime Coat: Organic Zinc Rich Primer (Minimum 80% Zinc by Weight)

@ 3.0 to 4.0 mils DFT

Carboline Carbozinc 859
International Paint Interzinc 52
PPG Amercoat 68HS
Sherwin Williams Corothane I GalVaPac

94-H20 Hydro-Zinc

Stripe Coat: Epoxy @ 2 to 3 mils DFT

**Tnemec** 

Carboline Carboguard 60
International Paint Intergard 345
PPG Amerlock 2/400
Sherwin-Williams Macropoxy 646

Tnemec N69 Hi-Build Epoxoline II

Intermediate Coat: Epoxy @ 4 to 6 mils DFT

Carboline Carboguard 60
International Paint PPG Intergard 345
PPG Amerlock 2/400
Sherwin-Williams Macropoxy 646

Tnemec N69 Hi-Build Epoxoline II

Color: As approved by OWNER

Finish Coat: Polyurethane, High Gloss @ 4.0 to 6.0 mils DFT

Carboline Carbothane 134HG
International Paint Interthane 990
PPG Amercoat 450H
Sherwin-Williams Acrolon 218

Tnemec Series 1094 Endura-Shield

Color for Tank: As required by OWNER

Colors for Tank Logos: City Logo colors include Reflex Blue, PMS 5757, PMS 5767, PMS

581, PMS 5905, PMS 5945, PMS 117, and PMS 117 – 0 Tint

Coating System Thickness: 11 to 16 mils total dry film thickness.

4 mils minimum any single coating layer with exception of the prime

coat.

Surface Preparation

Carbon Steel: Weld seams and abrasions shall be SSPC-SP 6, NACE 3 Commercial Blast

Cleaned. Shop primed components that that are not coated with successive coats within the Coating Manufacturer's recommended recoat window and shop applied holding primer shall be "sweep blasted" in accordance with SSPC-SP 7 Brush-Off Blast Cleaning. Existing and new weld profiles should

conform to NACE SP0 178, Profile D or better.

Surface Preparation Ductile Iron/Cast

Piping and Valves: NAPF 500-03-01, NAPF 500-03-04 and NAPF-03-05. Degree of Cleanliness,

Blast Clean #3.

Surface Profile: Coating Manufacturer's requirement but not less than two (2) mils.

Adhesion: The coating system shall have a minimum adhesion of no less than five

hundred (500 psi) for each of five (5) tests, as tested per ASTM D 4541 after

seventeen (17) days cure at minimum 40 degrees F.

Special Note 1: Stripe coat shall be applied to all welds, weld seams, and tack welds (new and

old), edges, bolts (with exception of hot-dipped galvanized bolts, nuts and washers), rivets, ladder rails and rungs (where required), seamed corners, joints of any kind and locations where brackets, lugs and other difficult to coat surfaces exist. Stripe coat on all welds and weld seams shall extend two (2) inches minimum above, below and beyond all welded sections. Stripe Coat

may be applied during application of finish coating.

Special Note 2: Multiple coats may be required to obtain desired appearance, recommended

dry film thickness and adequate hiding or coverage of the underlying coating.

Special Note 3: The logo and name shall be applied in accordance with the details. The two

(2) logos shall be field applied with ten (10) colors each, 24 feet high by 21.6 feet wide. The text, City of Leander, broken in into two (2) lines with a total height of 24 feet shall be field applied in the font selected by the OWNER. Dimensions are based on a 25.5 foot vertical tank wall, to be adjusted as necessary for differing tank wall heights. Logo to be centered vertically on tank

wall.

Special Note 4: Surfaces that are not to be prepared and coated including, but not limited to

hot-dipped galvanized bolts, nuts and washers, sight glasses, gages, name tags, ladders, conduits, and light fixtures shall be protected from surface preparation and coating operations. The CONTRACTOR shall be responsible

for damage to these items.

Special Note 5: Do not paint copper tubing and brass gate valves on sample and pressure

taps.

Special Note 6: Do not paint bolts in flange assembly for drain cam lock flange assembly at

outside base of pedestal. Bolts in flange assembly shall be hot-dipped galvanized and shall include hot-dipped galvanized flat washers under the bolt heads and nuts. Due to dis-similar metals in the flange and bolts assemblies.

dielectric isolation kits shall be installed for the bolt assemblies.

Special Note 7: The outside coating system shall be applied six (6) inches onto any stainless

steel materials that may be welded to the outside of the tank. The stopping point on the stainless steel surfaces that are to be coated shall be masked with tape that is the same as our equal to painter's tape, duct tape shall not be used. After application of the coating and the coating system has dried (not

cured) to a soft consistency the tape shall be removed.

Special Note 8: CONTRACTOR shall prevent dirt and debris from becoming adhered to the

surface or imbedded in the coatings during application and cure time. If dirt and debris become adhered to or embedded in the coating, the

CONTRACTOR shall remove the dirt and debris and recoat the area.

### 2.2 Caulk Schedule:

### OC - 01 Outside Dry System

Joints between pipes and pedestal wall for pipes entering and exiting the pedestal wall

Special Note 1:

After surface preparation and application of primer coating, and before application of the intermediate coating, caulk shall be installed in the joints filling the joints level with the pedestal wall.

### Part 3: EXECUTION

#### 3.1 General

- A. Food and drink (with exception of water) will not be allowed inside the tank or in close proximity to the outside of the tank at any time and is therefore, prohibited.
- B. Tobacco products and electronic vaporizers or e-cigarettes are prohibited from use on any City of Leander Water Utility Property.
- C. All materials shall be handled and applied in accordance with the Coating/Lining Manufacturer's recommendations. No coating shall be applied while water is in the tank.
- D. All coating material for the outside finish coating shall be mixed from one batch number. Batching shall occur so that the shelf life extends beyond the end of the project.
- E. All blasting and coating equipment shall be in first class condition and comply with all recommendations of the Coating Manufacturer and these Specifications. The OWNER reserves the right to have the CONTRACTOR immediately repair, modify or remove equipment functioning poorly or creating a nuisance as determined by the OWNER.
- F. The CONTRACTOR shall provide workers who perform professional and quality work and who are experienced and knowledgeable in surface preparation and mixing and application of high performance coating systems.
- G. The CONTRACTOR AND THE CONTRACTOR'S painting technicians that will be responsible for application of 100% solids coatings on this project shall be trained and certified by the Coating Manufacturer for application of the 100% solids coatings. Training and Certification shall be performed at the project site in the presence of the OWNER'S Representative(s). The painting technician(s) shall hold a current certification card for application of the 100% solids coatings. This card shall be made available for review upon request at any time by the OWNER and/or the OWNER'S Representative(s). The certified painting technicians shall demonstrate their proficiency in applications of 100% solids coatings/linings on "mockups" similar to that of the tank inside roof surfaces at the project prior to application of the lining on the surfaces of the tank.
- H. The OWNER and/or the OWNER'S Representative(s) reserves the right to disqualify the CONTRACTOR'S painting technician(s) for lack of proficiency in application of any of the coatings and/or linings for this project.
- I. Coating application procedures shall conform to the standards of craftsmanship as discussed in the Steel Structures Painting Manual, Volume 1 "Good Painting Practice".
- J. All thinning shall be as specified by the Coating Manufacturer's recommendations. Use only those thinners expressly approved by the Manufacturer for the coatings and linings used on this project. All thinners used with inside surface coatings/linings shall be those tested and approved by NSF 61/600 in conjunction with the NSF 61/600 approved coating materials. Thinners shall not be stored in unmarked containers at any time.

- K. Proper illumination equipment shall be provided by the CONTRACTOR in accordance with SSPC Guide 12. Explosion-proof lights and electrical equipment shall be provided. Whenever required by the OWNER and/or OWNER'S Representative the CONTRACTOR shall provide additional illumination and necessary supports to cover all areas to be observed and/or tested. The level of illumination for observation and/or testing purposes shall be determined by the OWNER and/or OWNER'S Representative. Project lighting shall not interfere with existing residences, schools, churches, businesses, etc. Complaints from adjacent residential neighbors, schools, churches, businesses, etc., shall require CONTRACTOR to modify lighting plan to resolve complaint. Project lighting is considered subsidiary work relating to various bid items of the contract.
- L. The CONTRACTOR'S Inspector shall perform quality control observations and tests to ensure that the requirements of these Specifications have been met prior to the CONTRACTOR setting a schedule or schedules for the OWNER'S Representative to perform verification observations and/or tests.
- M. The CONTRACTOR at his option may install painter's nipples in the roof of the tank for the purpose of supporting staging equipment inside the tank for abrasive blasting and paint operations. The nipples, if installed shall remain part of the tank after construction is finished on the project. Welded installation and protection of the nipples shall be in accordance with project design drawings. Location of installation for the nipples shall be the responsibility of the CONTRACTOR. Location of installation shall be detailed in shop drawings and submitted to the OWNER for review prior to installation. Costs for materials and labor to install the nipples shall be subsidiary to other bid items in the contract. Under no circumstances will CONTRACTOR equipment be allowed to be supported from any part of the tank inside roof structure or shell.
- N. Wind speed and direction shall be monitored during abrasive blasting and coating operations with automated equipment for the duration of the project on the roof of the tank and five (5) feet above ground level. Ground level equipment shall be placed in the path of winds regardless of directional change. Continuous reporting of the wind speed and direction shall be made a part of the CONTRACTORS Daily QC reports.
- O. The CONTRACTOR shall monitor emissions during construction to ensure no hazardous materials jeopardize worker or public health and that no contamination of air or soils occurs. Monitoring of emissions shall be in accordance with Method G, Visual Assessment of Site Cleanliness of SSPC Guide 6.

### 3.2 General Surface Preparation

- A. The CONTRACTOR shall provide to the OWNER written protective measures and procedures regarding workers and other persons on the site as required in **PART 1: GENERAL**, **1.6 Submittals**, **Paragraph A.16 and B.4** of these Specifications.
- B. CONTRACTOR shall, at a minimum, prepare all surfaces to receive lining and coating per Coating Manufacturer's requirements, and **Part 2: LINING AND COATING SCHEDULE** of these Specifications for minimum surface profiles.
- C. Plastic sheeting covered with an absorbent material shall be placed under all equipment capable of leaking oil, gasoline, diesel fuel or hydraulic fluid onto the ground or pavement. Any areas of the ground or pavement damaged or contaminated due to CONTRACTOR'S leaking equipment shall be remediated or replaced by the CONTRACTOR at the CONTRACTOR'S expense and to the satisfaction of the OWNER.
- D. Equipment with water and/or oil leaks will not be allowed inside or on the tank, or on the project site at any time during the project.
- E. All surfaces shall be free of dirt, dust, oil, grease, welding slag and other debris prior to coating. All applicable equipment shall be electrically grounded as required and shall have clean operating gauges, moisture traps, etc.

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- F. Effective oil and water separators combined with after coolers or deliquescent dryers shall be used in compressed air lines serving abrasive blasting operations to remove detrimental oil and moisture from the air. Separators shall be placed as far as practical from the compressor. Compressors may be tested periodically by the OWNER and/or OWNER'S Representative for oil and water contamination of compressed air. Testing shall follow ASTM D4285 "Standard Test Method of Indicating Oil and Water in Compressed Air". All compressor units found to produce unacceptable amounts of oil and or water, as determined by results of ASTM D4285 test data and interpretation of data by the OWNER and/or OWNER'S Representative shall be replaced with a compressor that is acceptable to the OWNER and/or OWNER'S Representative. The contractor at a minimum shall test the compressed air once per day in accordance ASTM D4285. Cloths used for the test shall be made available to the OWNER'S Representative for review. Test results shall be recorded on the CONTRACTOR'S daily QC report.
- G. No outside surface preparation shall begin:
- 1. When the surface, air or material is below or above the Coating/Lining Manufacturer's printed instructions for wet or damp surfaces or in rain, snow, fog or mist.
- 2. When the air or steel temperature is less-than or equal to 5 degrees F above the dew point temperature.
- 3. If the relative humidity is above eighty-five percent (85%).
- 4. If inclement weather (rain, hail, snow, etc.) is expected in the area within eight (8) hours after applications of coating.
- 5. When it is expected that the air and/or surface temperature will be below or above the Coating Manufacturer's recommended temperatures.
- 6. Additionally, if the above conditions are prevalent, surface preparation shall be delayed or postponed until conditions are favorable
- H. The environment on the inside of the tank shall be controlled for abrasive blasting operations as detailed in **PART 3: EXECUTION, 3.8 Ventilation and 3.9 Dehumidification** of these Specifications.
- I. Care shall be taken not to allow detrimental solvent or detergent residues to remain on any surfaces.
- J. Areas to be power tool cleaned shall not exceed two (2) feet in diameter.
- K. All pre-assembled shop primed items shall be blasted in accordance with these Specifications and observed or tested by the OWNER'S Representative before and after priming.
- L. For both immersion and non-immersion surfaces, all sharp edges and welds shall be ground smooth to a rounded contour, and all weld spatter and welding slag shall be removed prior to abrasive blasting. Additionally, any oil or grease that may be present shall be removed from the surfaces prior to abrasive blasting. Costs for grinding and removal of sharp edges, welding slag, and removal of oil and grease shall be subsidiary to other bids items in the contract.
- M. Abrasive materials used shall be non-carcinogenic when properly used, properly graded, be sharp, have proper angularity, and be clean and free of dirt, oil water and heavy metals concentrations such as Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium and Silver, that would require abatement as a hazardous material. The grade shall be of such size as to achieve an acceptable anchor pattern or surface profile as required by the Coating Manufacturer. Additionally, the CONTRACTOR shall adhere to the following:
- 1. Recovery of all abrasive blast or pressure washing waste will be mandatory during all inside and outside blasting. See **PART 3 EXECUTION**, **3.10 Protection of Existing Structures**, of these Specifications.

- 2. All abrasive blasting or pressure washing shall be finished and all waste shall be removed from the prepared surfaces and outlying areas prior to application of the coating/lining. The CONTRACTOR shall be responsible for covering surfaces inside the tank to prevent lining overspray from adhering to tank surfaces.
- 3. The CONTRACTOR'S abrasive blasting operations shall not cause staining of any newly applied coating on any part of the tank surfaces.
- 4. The TCEQ has established, under Regulation I, Control of Air Pollution and Visible Emissions from Particulate Matter, Standard 31 TCEQ 111.131, 111.133, 111.135, 111.137, and 111.139 titled "Abrasive Blasting of Water Storage Tanks Performed by Portable Operations". All work shall be performed in accordance with these regulations as applicable and are hereby made part of this Specification by reference. Questions and information regarding these regulations should be addressed to:

Texas Commission on Environmental Quality P.O. Box 13087 Leander, Texas 78711-3087 (512) 908-1000

- 5. The CONTRACTOR shall contain all waste and process discharge in accordance with the accepted methods for the process and materials that are in abatement.
- 6. Under no circumstances will any waste materials or its packaging be removed from the site without the OWNER'S written permission.
- 7. All waste shall be contained and characteristics determined in accordance with EPA regulations found under 40CFR216 Subpart B-Criteria for identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste and applicable TCEQ regulations.
- 8. Air filtration/dust collectors shall be used in conjunction with the dehumidification and/or ventilation equipment during inside abrasive blasting and coating operations.
- 9. Where abrasive blast cleaning will not remove or properly prepare metal surfaces, hand and/or power tool cleaning shall be used to remove such conditions as weld spatter, laminations and radius-sharp edges. Power tool cleaning, when needed, shall for areas not greater than two feet as specified in **PART 3 EXECUTION**, **3.2 General Surface Preparation**, **Paragraph J** of these Specifications. The areas to be power tool cleaned shall be agreed upon by the OWNER and or the OWNER'S Representative.
- 10. After outside abrasive blast cleaning, dust and spent abrasive shall be removed from the surfaces by air blasting and brush sweeping. The prime coat shall be applied as soon as possible after the blasting and surface cleaning is completed, observed, tested and determined to be in compliance by the OWNER'S Representative.
- 11. After inside abrasive blast cleaning, dust and spent abrasive shall be removed from the surfaces by air blasting and brush sweeping. The lining shall be applied after the blasting and surface cleaning is completed, observed, tested and determined to be in compliance by the OWNER'S Representative.
- 12. All abrasive blast equipment shall be equipped with, including but not limited to the following:
  - a. Noise reducing devices
  - b. Hose coupling safety devices
  - c. Electrical grounding devices
  - d. Moisture traps and filters

- e. Fresh air hoods for all blasters
- f. "Dead Man" switches on all blast hoses
- g. Air Dryers
- O. All applicable equipment shall be electrically grounded as required and shall have clean operating gauges, moisture traps, etc.
- P. IN ALL CASES THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING HIS WORKER'S SAFETY AND HEALTH WHILE ON THE PROJECT. CHANGE ORDERS FOR ADDITIONAL COSTS INCURRED BY THE CONTRACTOR TO PROTECT HIS WORKER'S SAFETY AND HEALTH WILL NOT BE CONSIDERED.

### 3.3 Tank Outside Surface Preparation

- A. Closed Abrasive Blast Cleaning with Recyclable Abrasives:
- 1. Where locations on the outside of the tank permit, closed abrasive blast cleaning shall be performed with centrifugal wheels within a vacuum assembly that propels abrasives to the surface. This type of abrasive blasting equipment shall simultaneously remove the abrasive and debris and recycle the abrasive on all surfaces that are suited for this type blasting equipment.
- 2. Ground covers shall be used to prevent all blasting abrasive and waste from contaminating the soil and all surfaces around the tank.
- B. Open Abrasive Blast Cleaning with Recyclable Abrasives:
- 1. This type of abrasive blasting will only be permitted at locations on the tank that do not permit the use of equipment specified in **PART 3 EXECUTION**, **3.3 Tank Outside Surface Preparation**, **Paragraph A.1** of these Specifications.
- 2. Ground covers shall be used to prevent all blasting abrasive and waste from contaminating the soil and all surfaces around the tank.
- C. Power Tool Cleaning:
- 1. Power tool cleaning may be performed on areas as described in **PART 3 EXECUTION**, **3.2 General Surface Preparation**, **Paragraph J** of these Specifications. The areas to be power tool cleaned shall be agreed upon by the OWNER and or the OWNER'S Representative.

# 3.4 Tank Inside Surface Preparation

- A. CONTRACTOR equipment used in the tank before, during and after surface preparation shall not leave any oily residue from exhaust or other sources. Internal combustion driven equipment other than that powered by bottled gas shall have catalytic exhaust purifiers. This equipment shall not produce a carbon monoxide concentration of 15 PPM or greater.
- B. The CONTRACTOR shall provide covers and plugs for the intake & discharge piping at the point where the pipe enters the water tank to prevent debris, or any other foreign matter from entering the water mains. The covers and plugs shall be installed before any CONTRACTOR work is allowed inside the tank. The covers and plugs shall remain in place from beginning of the tank interior work until just prior to back flushing the pipes. The CONTRACTOR shall be responsible for removal of debris, dirt, dust, etc. from the pipes that were deposited by the CONTRACTOR'S work. Removal shall occur prior to the OWNER back flushing the pipes. Cleanliness of the pipes shall be as determined by the OWNER.

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- C. Closed Abrasive Blast Cleaning with Recyclable Abrasives:
- 1. Where locations on the inside of the tank permit, closed abrasive blast cleaning shall be performed with centrifugal wheels within a vacuum assembly that propels abrasives to the surface. This type of abrasive blasting equipment shall simultaneously remove the abrasive and debris and recycle the abrasive on all surfaces that are suited for this type blasting equipment.
- D. Open Abrasive Blast Cleaning with Recyclable Abrasives:
- 1. This type of blasting will only be permitted at locations on the tank that do not permit the use of equipment specified in PART 3 EXECUTION, 3.4 Tank Inside Surface Preparation, Paragraph C.1 of these Specifications.

### 3.5 Coating and Lining Application

- A. All surfaces shall have been prepared as required in **PART 3 EXECUTION**, **3.2 General Surface Preparation**, **3.3 Tank Outside Surface Preparation**, **and 3.4 Tank Inside Surface Preparation** of these Specifications. All surfaces shall be free of dirt, dust, oil, grease, other debris prior to coating or lining.
- B. Prepared surfaces shall be coated before rust forms on the surface. All abrasive blasted surfaces shall be coated to within six (6) inches of the edge of an abrasive blasted area. No visible rust shall be coated under any circumstances, including rust bloom or if discoloration has occurred, regardless of elapsed time between blasting and coating. All surfaces that require abrasive blasting or power tool cleaning and that are not protected by DH, shall be coated within eight (8) hours after being abrasive blasted or power tool cleaned. Surfaces not coated within this eight (8) hour period shall be re-prepared with the required method prior to being coated. In all cases, tank surfaces not protected by DH shall be coated the same day as prepared. If the prepared surfaces are left overnight without being coated, the surfaces shall be re-prepared with the required method prior to being coated.
- C. The CONTRACTOR shall apply each coat at the rate and in the manner specified by the Coating Manufacturer, except as may be modified herein. If material must be diluted for application, coating shall be applied at the same dry film thickness as specified for each coat of the complete system.
- D. The coating curing period shall be adjusted to compensate for less than adequate weather conditions, as recommended by the Coating Manufacturer, for complete curing of the entire coating system.
- E. Successive layers of coating shall be tinted to make each coat easily distinguishable from the previous. Coating shall be continuous and shall be accomplished in an orderly manner to facilitate proper inspection.
- F. Where a roller or brush is used to apply the outside coating, additional coats may be necessary to achieve the recommended dry film thickness and/or to achieve total coverage of the underlying surface or coating. Coated surfaces shall be free of all roller nap, roller marks, brush bristles and brush marks.
- G. To the extent possible, the inside and outside of all piping entering through the wall of the pedestal or floor of the tank shall be blasted and coated the same as the surfaces of the tank. The inside of piping entering through the tank floor or pedestal floor, if not cement lined, shall be abrasive blasted and coated the same as the inside of the tank. These requirements shall not be applicable to inside of stainless steel piping.
- H. All metal surfaces, including stainless steel, inside the tank including the inside of the overflow weir shall be coated. The coating shall be monolithic and shall be Holiday free. However, the following surfaces will not require coating and shall be protected from blasting and coating materials:
- 1. Ladder Safety Climb Device

- 2. Inside of Stainless Steel Roof Hatch
- 3. Inside the one (1) inch level indicator nipple
- 4. Inside the one (1) inch sample tap nipple
- I. Drying time between coats, both minimum and maximum, shall be as specified by the Coating Manufacturer's recommendations with variables including temperature and humidity taken into account.

### 3.6 Stripe Coat

- A. See Special Note 3 of Coating System IW 01 for stripe coating requirements.
- B. See Special Note 1 of Coating System OD 01 for stripe coating requirements.
- C. See Special Note 1 of Coating System OD 02 for stripe coating requirements.
- D. See Special Note 1 of Coating System OD 03 for stripe coating requirements.
- E. See Special Note 1 of Coating System ALT OD 01 for stripe coating requirements.
- E. For outside surfaces, brush applied stripe coating is accomplished by moving the brush back and forth in a scrubbing motion working stripe coating into all crevices. Brush applied stripe coat shall be tinted such that it can be easily distinguished from the other coats. Stripe coating shall be performed with high quality bristle brushes using coating that has been thinned according to Coating Manufacturer's instructions. Bristles left on the surface shall be removed before the coating dries. If bristles are discovered after the coating has dried, the bristle shall be removed, and the area correctly re-coated at no additional cost to the OWNER.

### 3.7 Finish

A. All lining and coating layers shall be inspected visually and shall be free of all physical defects including but not limited to sags, runs, bubbles, drips, waves, laps, unnecessary brush marks, over spray, environmental contaminants, shadows, and shall be uniform in color, texture and gloss. Thus, all coatings and linings shall be applied in a professional manner to achieve the specified dry film thickness (DFT) leaving a smooth and uniform coating. Sanding shall be performed between applied coats. Sanding shall not be performed on the exterior final coating except to remove physical defects discussed above. If any of these are removed from the final exterior coating, an additional coat of the final coating shall be applied on the sanded area. Application of additional final coat shall extend from weld seam to weld seam.

B. Cleaning shall be scheduled such that dust and other materials from adjoining work will not contaminate wet or newly coated surfaces.

#### 3.8 Ventilation

A. From the beginning of tank inside wet surface lining and until the lining is cured, the CONTRACTOR shall monitor the air for the lower explosion limit (LEL) as published in the Coating Manufacturer's product MSDS. The OWNER and/or OWNER'S representatives shall be allowed to check and observe the monitor at any time.

- B. During any time workers are inside the tank, the level of Carbon Monoxide (CO) shall not be allowed to exceed a threshold limit value of twenty-five (25) ppm as an eight (8) hour time waited average.
- C. Continuous forced fresh air ventilation shall be provided from beginning of the tank inside wet area surface preparation through final coating operations and coating curing. When dehumidification equipment is used to provide ventilation of the inside of the tank, the roof vents shall be kept open and

clear. All tank openings susceptible to emissions during blasting, cleaning, and coating operations shall be properly fitted and secured with suitable dust collection devices to reduce the release of emissions. For required air changes in the wet area of the tank see **PART 3 EXECUTION**, **3.9 Dehumidification**, **Paragraph F.3, Air Change** of these Specifications.

- D. The above ventilation requirements are minimum requirements of the OWNER. It is the responsibility of the CONTRACTOR to verify that the flow rate provided through the tank meets the lining curing requirements of the Coating Manufacturer and these Specifications. Should additional ventilation be required by the Coating Manufacturer, the CONTRACTOR shall furnish additional ventilation at the CONTRACTOR'S expense.
- E. Throughout the duration of ventilation, containment of abrasive blasting abrasives, removed coating, and applied coatings and linings shall be maintained by use of proper filtration.

### 3.9 Dehumidification

- A. Dehumidification equipment shall be used to control the environment in the tank wet area and roof twenty four (24) hours a day during blast cleaning, lining application and lining cure.
- B. Approved automatic real time environmental monitoring equipment shall be provided. This equipment shall be used when no CONTRACTOR personnel are on site.
- C. Desiccant dehumidifiers are required and shall be a solid desiccant design having a single rotary desiccant wheel capable of fully automatic continuous operation. No liquid, granular, or loose lithium chloride drying systems will be permitted. The desiccant wheel shall be made of a fire retardant material tested to ASTM Standard E 84. Air conditioning units may be used only if in combination with Desiccant units to control temperature.
- D. The CONTRACTOR shall furnish all labor, materials, equipment, fabrication and quality control observations, and all other incidentals required to control and maintain the environment of the inside of the tank within the parameters stated in these Specifications. All costs associated with maintaining the environment inside the tank shall be incorporated in the CONTRACTOR'S bid.
- E. In the event the dehumidification equipment is not performing to the minimum requirements stated in these Specifications, the OWNER reserves the right to require the CONTRACTOR to modify and/or provide additional equipment to satisfy the requirements of these Specifications. Modifications and/or providing additional equipment shall be at the sole cost of the CONTRACTOR.
- F. The Coating Manufacturer's minimum limits of surface temperature, tank inside air temperature and relative humidity requirements shall govern if more stringent than the requirements stated within this Specification:

### 1. Surface Temperature:

- a. Abrasive cleaning operations:
  - I. Dew point minimum of 17 degrees F below the surface temperature of the tank inside.
- b. Coating operations:
  - I. Surface temperatures shall be no less than 40 degrees F or the published Coating Manufacturer's recommendations. The Coating Manufacturer's recommendations shall govern if minimum temperature required is greater than 40 degrees F. The maximum air and surface temperature shall not exceed the published recommendation of the Coating Manufacturer.
  - II. Dew point minimum of 17 degrees F below the surface temperature of the tank inside.

### c. Coating curing:

Dew point - minimum of 10 degrees F below the surface temperature of the tank inside.

### 2. Relative Humidity:

- a. Abrasive cleaning operations:
  - I. The relative humidity (RH) of the tank inside ambient air shall not exceed 55% RH as measured by a sling psychrometric or another measuring device such as a continuous electronic monitoring device (EMD).
  - II. The tank inside ambient air shall be maintained, as stated in the preceding paragraph, until the abrasive cleaning operations have been completed and coating operations have covered all bare substrates.

## b. Lining operations:

I. During lining operations, the relative humidity of the tank inside ambient air shall not exceed 55% RH as measured by a sling psychrometric or another measuring device such as a continuous EMD.

## c. Lining curing:

I. During lining curing the relative humidity of the tank inside ambient air shall not exceed 75% RH as measured by a sling psychrometric or another measuring device such as a continuous EMD.

## 3. Air Change:

- a. Abrasive cleaning and coating operations:
  - I. The equipment shall be sized so that it is capable of changing the volume of the air inside the entire tank a minimum of one (1) time per hour during abrasive blasting and coating operations.
- b. Lining curing:
  - I. During lining applications and lining curing inside the tank the equipment shall be sized so that it is capable of changing the volume of the air inside the entire tank a minimum of one (1) time per hour.

## 4. Air Distribution:

- a. The process air shall be distributed so as to be able to contact the entire tank inside. If necessary, special equipment shall be provided to achieve this requirement.
- b. To prevent the introduction and distribution of moisture into the controlled environment during the abrasive cleaning operation, air compressors shall be operated with after coolers and/or deliquescent dryers for moisture removal.
- c. Air filtration/dust collectors shall be used in conjunction with the dehumidification equipment during blasting operations.

#### 5. Power:

a. Contractor shall provide temporary electrical power as necessary, and/or shall complete the installation of the electrical service to the site. Power requirements shall be determined and coordinated by the Contractor and no additional cost.

b. The heaters in all desiccant dehumidification units shall be propane powered. The OWNER may consider requests from the CONTRACTOR to use electrical power for the heaters if sufficient electrical power is available. Use of air conditioning to achieve dehumidification will not be allowed.

## 3.10 Protection of Existing Structures

- A. The CONTRACTOR shall take every precaution available while preparing surfaces and during lining and coating operations to avoid dusting or spraying nearby residences, businesses and vehicles with either blast debris or overspray coating.
- B. Prior to any surface preparation or coating application, the ground surrounding the tank shall be covered with tarps or a similar ground cover that will allow for recovery of old paint scraps, debris, blast media and new paint materials.
- C. If, in the opinion of the OWNER or OWNER'S Representative modifications or repairs to the ground cover are necessary, blasting and coating operations shall stop until the OWNER or OWNER'S Representative indicates to the CONTRACTOR that adequate repairs have been made.
- D. The CONTRACTOR is responsible for complete clean-up of all blasting abrasive, blasting abrasive dust or coating deposited on surfaces that are not to be blasted or coated. The CONTRACTOR shall be responsible for all costs for the removal. Removal shall be acceptable to the OWNER.
- E. The CONTRACTOR is responsible for any and all damages to on-site facilities, residences, vehicles and/or public health, including any fines or penalties resulting from improper containment during blasting or coating of the tank.
- F. All security and electrical equipment (light poles, control panels, etc) shall be protected by construction of temporary fences or barricades around all above ground devices. Four (4) feet shall remain clear of construction materials and activities around all security equipment devices.

### 3.11 Pedestal and Tank Openings

A. The tank property shall be protected with either temporary or permanent construction fencing with lockable gates and all pedestal openings shall be secured with lockable gates.

### 3.12 Testing/Inspections

- A. The CONTRACTOR'S Inspector shall perform quality control tests and inspections of the work as it progresses.
- B. Verification tests and inspections shall be conducted by the OWNER'S Representative or third party testing company and the OWNER'S Representative. The CONTRACTOR'S Inspector shall accompany the OWNER'S Representative and/or the third party Inspector during verification tests and inspections. Final tests and inspections shall be performed in the presence of the OWNER or the OWNER'S Representative, and the CONTRACTOR'S Inspector and Superintendent. Periodic testing and observation times shall be agreed upon by the OWNER'S Representative and/or the third party Inspector and CONTRACTOR. The CONTRACTOR shall furnish all equipment necessary for the OWNER'S Representative and/or the third party Inspector to perform their inspections and testing. The equipment shall be acceptable to the OWNER'S Representative and/or the third party Inspector. If the equipment is not acceptable it shall be replaced to the satisfaction of the OWNER'S Representative and/or the third party Inspector. The CONTRACTOR shall also provide all requested assistance to the OWNER'S Representative and/or the third party Inspector.
- C. The OWNER may conduct tests and inspections to verify the Coating Manufacturer's data for the coatings on this project. If the coating testing results fall below the test requirements, the OWNER reserves the right to have the CONTRACTOR replace the coating materials and Coating Manufacturers if necessary to meet ALL stated requirements in these Specifications.

- D. All steps of the lining and coating systems will be subject to testing and observation prior to progression to succeeding steps. Phases of testing and observation shall include, but may not be limited to:
- 1. Pre-cleaning before surface preparation.
- 2. During surface preparation and prior to lining and coating application.
- 3. During and immediately after each lining and coating application.
- 4. Final testing and observation of lining and coating systems.
- 5. Pre-disinfection.
- E. The CONTRACTOR shall not move or remove scaffolding, ladders or other fixtures necessary to provide proper testing and observation until such work has been tested and observed, by the OWNER'S Representative and/or the third party Inspector.
- F. Any work found to be deficient, damaged, or otherwise unacceptable shall be repaired in accordance with the Coating Manufacturer's latest written repair recommendations. Repair work shall be at no additional cost to the OWNER.
- G. The OWNER'S Representative and/or the third party Inspector will make reasonable attempts to minimize damage to newly coated or lined areas during testing and observation activities. However, any damage caused, regardless of by whom, shall be repaired by the CONTRACTOR at no additional cost to the OWNER.
- H. Acceptance of CONTRACTOR'S work by OWNER, OWNER'S Representative and/or the third party Inspector in no way releases CONTRACTOR from any of the terms and conditions of the Contract Agreement and requirements of these Specifications.
- I. The following test and observations shall be performed:
- 1. All steel surfaces shall first be cleaned and observed by the CONTRACTOR'S Inspector to ensure that all grease, oil, and other foreign materials have been removed before abrasive blasting. Any area found to be improperly cleaned, shall be re-cleaned to the OWNER'S Representative's and/or the third party Inspector satisfaction. Final surface preparation shall be as outlined in The Society for Protective Coatings Surface Preparation Specifications SSPC SP1 through SP11 or the National Association of Pipe Fabricators, NAPF 500-03 as applicable. Prior to tests and observations of inside and outside surfaces by OWNER'S Representative and/or the third party Inspector, CONTRACTOR'S Inspector shall test and observe the surfaces to confirm readiness for the OWNER'S Representative and/or the third party Inspector, to perform tests and observations.
- 2. The profile depth of the abrasive blasted surface shall be as specified by the Coating Manufacturer's written surface profile recommendations, see **Part 2: LINING AND COATING SCHEDULE** of these Specifications for minimum anchorage profiles. The profile shall be measured by a Testex Tape in accordance with ASTM D4417. SSPC-Vis-1 Pictorial Surface Preparation Standards shall serve as guides and in arbitration to determine the degree of surface preparation. Each and every unit area of the tank surface inside and outside shall be prepared and coated or lined as required by these Specifications.
- 3. Before and during abrasive blasting and lining operations the CONTRACTOR shall test the tank inside ventilation flow rates at least once per week. Test results shall be recorded on the CONTRACTOR'S daily QC report. Observation and tests of ventilation flow rates may be performed by the OWNER'S Representative and/or the third party Inspector to verify that the ventilation requirements are being provided.

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- 4. Measurement of the dry film thickness shall be made in accordance with SSPC-PA2 (latest edition) with magnetic pull off or digital gauges. Measurements of the actual dry film thickness of the various lining and coating layers applied shall be made first by the CONTRACTOR'S Inspector. The CONTRACTOR shall assist the OWNER'S Representative with dry film thickness measurements of the various applied layers of coatings and linings. Final dry film thickness measurements shall be made at such locations as designated by the OWNER and/or OWNER'S Representative. The final dry film thickness shall be no less than the minimum required in **Part 2: LINING AND COATING SCHEDULE** of these Specifications and Level 2 of the SSPC-PA2 Standard.
- 5. After the final lining has cured as required by the Coating Manufacturer, all inside surfaces shall be tested for Holidays using a high voltage Holiday detector (voltage set at approximately one hundred (100) volts per mil thickness of the coating). During testing, defective areas shall be marked for repair. All repaired Holidays and re-coated areas shall have cured as required by the Coating Manufacturer prior to re-testing the repairs. Holiday testing and re-testing shall continue until the inside surfaces are found to be Holiday free. The OWNER'S Representative will begin Holiday testing at random spot locations. If Holidays are noted in twenty five percent (25%) of the locations tested the CONTRACTOR will have the following options;
  - a. Have the OWNER'S Representative stop testing so that the CONTRACTOR may retest 100% of the surfaces and make needed repairs prior to the OWNER'S Representative testing 100% of the surfaces.
  - b. Have the OWNER'S Representative continue testing 100% of the surfaces at the CONTRACTOR'S expense.
- 6. All costs, including actual labor and materials for retesting by the OWNER'S Representative, shall be borne by the CONTRACTOR and will be deducted from the Contract Value by Change Order.
- 7. On days when blasting and/or coating or lining are being performed, the CONTRACTOR shall monitor and record ambient climatic conditions on the inside and/or outside of the tank as applicable. Monitoring and recording shall be as follows:
  - a. Air temperature, steel surface temperature, humidity and dew point shall be measured and recorded daily by the CONTRACTOR prior to beginning of blasting and prior to application of coating. Surface temperature shall be measured using OWNER approved thermometers. The tank surface temperatures on the sunny side and shaded side, relative humidity, dry bulb, wet bulb and dew point temperatures on both the inside and outside are to be recorded at least every three (3) hours. The dew point shall be measured by use of a sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables. The CONTRACTOR shall use a form approved by the OWNER for recording this data. The completed forms shall be kept on the job site at all times from the time abrasive blasting begins to the time coating is first applied and until the coating system is cured.
- 8. Adhesion testing of the coating systems shall be performed in accordance with ASTM D-4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
  - a. A minimum of ten (10) adhesion tests shall be performed on the inside lining system.
  - b. A minimum of five (5), adhesion tests shall be performed on each layer of coating for the outside coating system.
  - c. If test results do not meet the requirements of these Specifications, additional tests will be performed as deemed necessary by the OWNER. If adhesion of coating or lining is below the requirements of these Specifications. Repairs shall be made by the CONTRACTOR at no additional cost to the OWNER. All repaired areas will be re-tested and shall continue to be re-tested until adhesion of the coating meets the requirements of these Specifications. All costs, including actual labor and materials for retesting by the OWNER'S Representative, shall be borne by the CONTRACTOR and will be deducted from the Contract Value by Change Order.

- Section 09900
- 9. All coatings submitted shall pass a seven (7) day chemical spot test to the following chemicals with no cracking, blistering or delamination:
  - a. 1,1,1 Trichloroethane
  - b. Methyl Ethyl Keytone (MEK)
  - c. Ethanol
- 10. Testing of Abrasive Blasting Waste:
  - a. All waste testing shall be performed by the CONTRACTOR using a third party testing company submitted to the OWNER for review. Reports shall be submitted to the OWNER for review prior to removal of waste from the site. If the waste is not a hazardous waste under the regulations that govern and is eligible for disposal in a City landfill, it shall be the CONTRACTOR'S responsibility to properly load, secure, transport, and dispose of all such waste. The CONTRACTOR shall submit a copy of all waste transportation invoices to the OWNER within seven (7) calendar days of waste removal.
  - b. If the waste is found to have one (1) or more of the eight (8) heavy metals with concentrations making it a hazardous waste or is listed as a hazardous waste, the CONTRACTOR shall secure the materials and containerize them, provide any required labels and markings, and dispose of the materials in accordance with the EPA, OSHA, TCEQ, Texas DOT, local, state and federal regulations.

## 3.13 Repair of Defects

- A. All defects in the coating or lining discovered by the OWNER and/or the OWNER'S Representative, or CONTRACTOR requiring repair shall be repaired in accordance with the Coating Manufacturer's written recommended methods.
- B. All repaired finish coats will be observed visually and shall be free of all sags, runs, bubbles, drips, waves, laps, unnecessary brush marks, over spray, environmental contaminants or other physical defects and shall be uniform in color, gloss and texture.

### 3.14 Reporting/Records

- A. All work, including tests and observations, shall be recorded daily by the CONTRACTOR. A copy of each daily report shall be emailed to the OWNER'S Representative on a daily basis. Information required by CONTRACTOR to include daily is listed in **Section 01300**, **Submittals** of the Project Manual. The reports shall also include, but not be limited to, the following information:
- 1. Date
- 2. Project Manager Name
- 3. CONTRACTOR and Subcontractor name (where applicable)
- 4. INSPECTOR name (where applicable)
- 5. Work Identification
- 6. Type of work performed
- 7. Location of work performed, indicated on generalized drawings of the tank, drawings shall include estimated square feet (ft²) of area blasted and/or painted and approximate percentage of total square feet (ft²) of area of surface being prepared and painted:

- a. Generalized drawings shall include:
  - I. Plan view of tank
  - II. Profile view of tank
  - III. Plate location
  - IV. North arrow
- V. Any other drawings that will help to indicate location of work performed
- 8. Time of day each portion of the work was started and finished.
- 9. Weather conditions, including corresponding time of day, before, during and after work begins including:
  - a. Temperature (air and surface)
  - b. Humidity/dew point
  - c. Wind velocity/direction
  - d. Remarks and results of work
  - e. CONTRACTOR signature

## 3.15 Cleaning and Disinfection of Tank

- A. Cleaning:
- 1. After all inside coatings/linings have been applied and cured, and all openings (except the tank floor drain and roof hatch) closed and sealed, but prior to installation of the new Cathodic protection system, CONTRACTOR shall thoroughly wash all dust, grit, and dirt from all inside surfaces.
- 2. CONTRACTOR shall perform a thorough spot cleaning (wet mop) of all wall and floor surfaces. Inside tank surfaces shall be free of all dirt, foreign materials, and contaminants prior to initiating the disinfection process.
- B. Disinfection:
- CONTRACTOR shall disinfect the tank in accordance with AWWA Standard C-652 Method 3.
- 2. CONTRACTOR shall provide sufficient fresh calcium hypochlorite to prepare a fifty (50) milligram per liter solution of chlorine in five percent (5%) of the total tank volume. CONTRACTOR shall coordinate with OWNER to fill the tank to five percent (5%) of its total volume for mixing a fifty (50) milligram per liter chlorine solution in that volume. After a six (6) hour detention period, CONTRACTOR/OWNER shall fill the tank to overflow.
- C. Testing:
- 1. Testing and disinfection shall be in accordance with AWWA C652 and Section 13210.
- D. Time Requirement:
- 1. CONTRACTOR shall include five (5) days (after tank interior cleaning) in the critical path schedule for this disinfection process.

2. Achieving a successful bacteriological test and placing the tank in service is one of the essential tasks in reaching Substantial Completion.

### 3.16 Anniversary Inspection

- A. The CONTRACTOR shall inspect all surfaces of the tank with the OWNER within eleven (11) to twenty-three (23) months after the tank work was accepted for Substantial Completion and placed in service. If an inspection date is not established within twenty-three (23) months after the tank was placed in service, the anniversary inspection shall be considered waved, except in the event the City of Leander is unable to remove the tank from service due to long dry climate conditions or otherwise adverse weather conditions or due to unexpected breakdowns in the City of Leander's Water distribution system. The date of anniversary inspection may be extended for a period of time not to exceed thirty (30) months beyond the date of Substantial Completion and acceptance of the work.
- B. If failures in any portion of the coating or lining exceeds five percent (5%) of that portion, as determined by the OWNER, then for that portion, the entire coating or lining system shall be completely removed, re-coated and re-tested in accordance with these Specifications. In the event any portion of the coating or lining requires repair, partial or complete, a second anniversary inspection shall be made unless the OWNER otherwise deems it not to be necessary. If subsequent anniversary inspections are made, time stipulations, coating or lining removal, repair and re-testing requirements shall be the same as provided for in these Specifications. Each subsequent repair will have a warranty inspection to occur after the repair is completed as stated above.
- C. The OWNER will isolate the tank from the distribution system and drain the tank. The CONTRACTOR shall open, clean out, high-pressure water wash and rinse the tank prior to the anniversary observation. After observation of the tank is complete and repair work accepted by OWNER, the CONTRACTOR shall follow disinfection procedures specified in **PART 3 EXECUTION**, **3.15 Cleaning and Disinfection**. Disinfection of the tank, after anniversary observation, shall be by OWNER as described above provided CONTRACTOR meets cleanliness requirements.
- D. The CONTRACTOR shall provide suitable and adequate equipment including, lighting, ventilation, rigging, safety climb devices, mirrors, inspection equipment, and sufficient man-power to clean, disinfect and move equipment and tools around the tank, as may be necessary to facilitate complete inspection of all inside surfaces. The CONTRACTOR shall bear all costs of the anniversary inspection and shall incorporate such costs into his bid. **Two percent (2%)** of the bid amount will be retained and paid upon satisfactory inspection and/or approved repairs.
- E. Any location, including but not limited to locations where a coating has peeled off, bubbled, blistered, chipped, or cracked, etc., or where pinholes and/or Holidays are present and locations where rusting or corrosion is evident, will be considered a failure or defect of the coating system and shall be repaired as required.
- F. Methods of testing for coating failure which, may or may not be evident, shall include, but not be limited to, adhesion tests, film thickness measurement, Holiday testing, etc. Testing may be non-destructive or destructive. The CONTRACTOR, at his expense, shall repair all areas where tests are performed.
- G. The anniversary repair work shall be completed within an agreed time period as determined by the OWNER and CONTRACTOR. All repairs shall be made as specified by the Coating Manufacturer's written repair procedures or that which is acceptable to the OWNER and completed within ninety (90) calendar days of the anniversary observation.
- H. Holiday testing will be used to check all tank inside coating repairs, including the inside of the roof.
- I. The CONTRACTOR shall be responsible for compensation to the OWNER for the OWNER'S cost for observations and tests of anniversary repair work and will be deducted from the Contract Value by Change Order.

# **PART 4 - MEASUREMENT AND PAYMENT**

4.1 No separate measurement payment for work performed under this Section. Include cost of same in the CONTRACT price bid for the item(s) of which this is a component part.

**END** 

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### **SECTION 11100**

## ELEVATED STORAGE TANK, GENERAL

## PART 1: GENERAL

#### 1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals for the completion of an Elevated Storage Tank and Site. This will include but is not limited to a new structure, electrical improvements, above and below grade piping/valves/appurtenances, grading, excavation, embankment, structural fill, retaining walls, driveway and parking pavement, fencing, retaining walls, concrete splash pad, etc. for a complete and operational elevated storage tank.

# PART 2: PRODUCTS

### 2.01 GENERAL

A. Products shall be as specified in the plans and specifications.

# PART 3: EXECUTION

#### 3.01 MEASUREMENT AND PAYMENT

- A. The reinforced ribbon curb per linear foot bid item shall include but is not limited to excavation, preparing subgrade, cushion material, all reinforcement, bar supports, joints, expansion joints materials, etc.
- B. The concrete sidewalk complete in place per square foot bid item shall include but is not limited to excavation, preparing subgrade, cushion material, all reinforcement, bar supports, joints, expansion joints materials, etc.
- C. The Elevated Storage Tank retaining wall (MSE) complete per square foot bid item shall include but is not limited to the retaining wall, concrete rip rap, concrete mow strip, pipe underdrains, etc.
- D. The Elevated Storage Tank 8-foot tall wrought iron fence complete in place per linear foot bid item shall include all work.
- E. The Elevated Storage Tank 8-foot tall 3-foot personal gate complete in place per each shall include all work.
- F. The Elevated Storage Tank 8-foot tall stone fence complete in place per linear foot bid item shall include all work.
- G. Elevated Storage Tank Concrete Splash Pad including excavation, compaction, reinforcing steel, formwork, rock riprap and all necessary incidentals complete and in place, per Lump Sum

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**END OF SECTION 11100** 

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### **SECTION 13210**

### COMPOSITE ELEVATED WATER STORAGE TANK

# PART 1: GENERAL

### 1.01 SECTION INCLUDES

A. Under this section of the specifications, the CONTRACTOR shall design, construct, test, disinfect, and commission a composite elevated water tank; including the tank foundation, and other related work items. The composite tank shall consist of a foundation, reinforced concrete support structure and a welded steel water tank. The support structure shall extend vertically from the foundation as a circular concrete wall. A domed concrete slab shall be provided as a structural support for the steel tank within the perimeter of the wall. A reinforced concrete ring beam shall be provided to connect the steel tank, concrete dome and concrete support wall.

### 1.02 RELATED SECTIONS

A. Section 03300 - Submittals
Section 09900 - Potable Water Tank & Mechanical Coatings
Sections 16000 to 16999 - Electrical

## 1.03 REFERENCES AND QUALITY ASSURANCE

- A. Material, design, coating, shop fabrication, erection, and inspection of the proposed water storage reservoir shall conform to all applicable most recent/updated sections of the AWWA Standard for Composite Elevated Tanks for Water Storage (AWWA D107), Standard for Welded Steel Tanks for Water Storage (AWWA D100), Coating Steel Water Storage Tanks (AWWA D102), Disinfection of Water Storage Facilities (AWWA C652) and the requirements of the state of Texas for potable water storage reservoirs except as noted herein. Construction of the storage tank and all appurtenances shall conform to the requirements of the Occupational Safety and Health Act (OSHA), state and local health regulatory agencies and Material Safety Data Sheets (MSDS). Contractor shall supply all safety equipment per OSHA requirements and manufacturer's written safety documentation.
- B. The latest edition of the following Specifications, Codes, and Standards are referenced as part this specification:
  - 1. American Concrete Institute
    - a) 117 Standard Tolerances for Concrete Construction & Materials
    - b) 304 Guide for Measuring, Mixing, Transporting & Placing Concrete
    - c) 305 Hot Weather Concreting
    - d) 306 Cold Weather Concreting
    - e) 318 Building Code Requirements for Structural Concrete
    - f) 347 Guide to Formwork for Concrete

- 2. American Institute of Steel Construction (AISC)
  - a) S335 Specification for Structural Steel Buildings
- 3. American National Standards Institute
  - a) B16.5 Pipe Flanges and Flanged Fittings
- 4. American Society of Civil Engineers
  - a) ASCE 7 Minimum Design Loads for Buildings & Other Structures
- 5. American Society for Testing Materials (ASTM)
  - a) A 123 Zinc Coatings on Iron and Steel Products
  - b) A 240 Stainless Steel Plate, Sheet and Strip for Pressure Vessels
  - c) A 285 Pressure Vessel Plates, Carbon Steel
  - d) A 774 Welded Stainless Steel Fittings
  - e) A 778 Welded Stainless Steel Tubular Products
- 6. Federal Aviation Administration (FAA)
  - a) 70/7460-1H Obstruction Marking and Lighting
- 7. National Association of Corrosion Engineers (NACE)
  - a) RP0178
- 8. National Fire Protection Association (NFPA)
  - a) National Electric Code
  - b) 780 Standard for the Installation of Lighting Protection Systems
- 9. National Sanitation Foundation (NSF)
  - a) 61 Standard for Drinking Water System Components
- 10. Steel Structures Painting Council (SSPC)
  - a) VIS-89 Visual Standard for Abrasive Blast Cleaned Steel
- C. The supplier of the potable water storage tank shall furnish a minimum warranty of 1 years on both exterior and interior coatings, and on materials and workmanship.
- D. Manufacturer The Work described in this section shall be performed by an elevated tank manufacturer that has a minimum of ten years experience in composite tank design and construction. The manufacturer shall have designed, constructed and commissioned a minimum of ten composite elevated tanks of equal or greater capacity within the last 10 years.
  - 1. Approved and Acceptable Tank Constructors / Manufacturers are CB&I Constructors, Inc., Caldwell Tanks, Inc., Landmark Structures, L.P., and Phoenix Fabricators and Erectors, LLC.
  - 2. Elevated tank design, concrete support structure construction, and steel tank construction shall be performed by the tank manufacturer and may not be subcontracted.

- 3. The tank manufacturer shall directly employ a full-time professional engineer Registered within the State of Texas, with a minimum five years cumulative experience in the design and construction of composite elevated tanks.
- 4. A qualified Supervisor, directly employed by the Contractor, shall be on site at all times during construction. Contractor shall designate the Supervisor and provide detailed experience records to the Engineer for review.
- 5. Insurance In addition to the requirements in the General/Supplemental Conditions, the Contractor shall maintain Professional Liability Insurance with a minimum limit of \$2,000,000 each occurrence and aggregate.

## 1.04 SUBMITTALS

- A. The CONTRACTOR shall submit to the ENGINEER at the time of the bid documents:
  - Experience List A completed contracts summary demonstrating a minimum of 10 years of experience, including a list of 10 composite elevated tanks of equal or greater capacity in successful operation for at least five years. List shall include contact information for the project Owner and/or Engineer for each project listed.
  - 2. A preliminary section view drawing of the tank proposed for this project. The drawing shall include sufficient detail to illustrate tank geometry, materials of construction, primary dimensions, support wall thickness and pour height, concrete slab thickness, the elevation of low and high-water levels, interior wet, interior dry and exterior paint areas, and other information required to show compliance with the specification. If the proposed design does not comply with the specifications, the bid shall be rejected.
  - 3. Proposed construction schedule, including major milestones such as Notice to Proceed (NTP), submittals, mobilization, start delivery of steel, tank structure erected, substantial completion, and final completion.
- B. The CONTRACTOR shall submit to the ENGINEER prior to mobilization:
  - Provide elevation, plan and sectional view drawings of the foundation, support structure, tank and all appurtenant equipment and accessories. Show the location, dimensions, material specifications, and finish requirements. The submission shall be sealed by professional engineer licensed in the State of Texas. Foundation details shall include excavation, soil protection and backfill.
  - 2. Reinforced concrete details shall include construction joints, openings and inserts. Reinforcement shall be clearly indicated on the structural drawings and identified by mark numbers that are used on the fabrication schedule. Location, spacing and splice dimensions shall be shown. Placement and fabrication details shall conform to ACI 318. Steel tank details shall include welded joints and a layout showing all primary and secondary shop and field welds.

- 3. Provide procedures for the support structure forming system. Procedures shall include form removal criteria and minimum elapsed time for adjacent concrete placement. Provide shop and field weld procedures for all structural joints on the steel tank.
- 4. Provide a table showing capacity of the tank in gallons at all levels in one-foot increments. Provide a summary of the design for the foundation, support structure, tank and other components. Include the design basis, loads, and load combinations and results. Design calculations and summary shall be sealed by a professional engineer licensed in the State of Texas.
- 5. Provide a separate concrete mix design for each of the concrete compressive strengths required. Provide technical data and color samples of all coating products. Provide manufacturers information for appurtenant equipment and accessories that are not detailed on the construction drawings.
- C. The CONTRACTOR shall submit to the ENGINEER prior to any field welding:
  - 1. Provide qualifications and welding certificates of all welders who will be performing field welds on this project.
- D. The CONTRACTOR shall submit to the ENGINEER during construction:
  - 1. Provide documentation of all tests, inspections, and certifications required by the contract documents. Testing and inspection reports are to be provided within seven days of each test. Certifications to be provided within fourteen days of the earliest date the item or work can be certified.
- E. The CONTRACTOR shall submit to the ENGINEER prior to project acceptance:
  - 1. Provide operating instruction and maintenance procedures for the elevated tank and for applicable appurtenant equipment, mechanical components and accessories.

## 1.05 DELIVERY, STORAGE & HANDLING

- A. Handling & Shipping The Contractor shall handle materials and fabricated components in a manner that will protect them from damage. Allow painted materials adequate cure time prior to stacking or shipping.
- B. Storage & Protection Protect delivered materials and equipment from damage. Store in well drained areas and provide blocking to minimize contact with the ground.

# 1.06 PROJECT CONDITIONS

A. A geotechnical investigation has been carried out at the site and a report has been incorporated within the project specifications in Appendix A. The Contractor shall

be responsible for securing any further geotechnical information required beyond that provided in this report.

B. Access to the site shall be via the access easement accessed off of Ronald Reagan Blvd. and/or the existing right-of-way of San Gabriel Parkway. See plans for both access points. Contractor shall be responsible for improving the gravel access road as necessary for their access and material deliveries, otherwise driveway shall be in left in the same or better condition at the end of the project. Contractor shall be responsible for providing any traffic control needed to supply safe access to the site.

## 1.07 SEQUENCING AND SCHEDULING

- A. Schedule The Contractor shall provide a schedule indicating the design, submittals, site work and the major components of construction including foundation, support structure and steel tank. In addition, show tank painting, electrical installation and other significant activities. Update the schedule as required.
- B. Notification Provide certification from the engineer of record that the elevated tank has been designed in accordance with the requirements of the specification.
- C. Certifications Provide certification from the tank engineer of record that the elevated tank has been designed in accordance with the requirements of the Contract Documents.

## PART 2: MATERIALS

## 2.01 COMPOSITE ELEVATED WATER STORAGE TANK

- A. The Composite elevated tank shall consist of the following: foundation, reinforced concrete support structure and a welded steel water tank. The support structure shall extend vertically from the foundation as a circular concrete wall. A concrete slab shall be provided as structural support for the steel tank within the perimeter of the wall. A reinforced concrete ring beam shall be provided to connect the steel tank, concrete dome and concrete support wall. The reinforced concrete materials and reinforcement shall comply with ACI 318, except as modified in this section. Steel tank components, including steel plates, sheets, structural shapes and filler metals shall be in accordance with AWWA D107, Section 2, "Materials." The elevated tank shall be in accordance with the shape, dimensions and details required by these contract documents.
- B. Operating Parameters Items listed below are for a tank capacity of 1.25 million gallons of storage.

1. Minimum Capacity in Operating Range

2. Operating Head Range

3. Maximum Fill Rate

4. Overflow Level

5. Full Capacity Level

6. Grade Slab (at vehicle door)

1,250,000 gallons

40.00 feet maximum\*

12,000 gallons per minute

1128.00 feet MSL

1127.00 feet MSL

992.25 feet MSL

7. Support Wall Diameter

40.00 feet minimum\*

\*Any changes from the tank dimensions and layouts shown on the plans shall be at no additional cost to the Owner. Changes include, but are not limited to, site work and inlet/outlet piping.

- C. Design Loads Design loads shall be in accordance with ASCE7 for Category IV (essential facility) structures.
  - 1. Dead load shall be the estimated weight of all permanent construction.
  - 2. Water load shall be the weight of water when the tank is filled to overflow.
  - 3. Roof live load in addition to snow load: none
  - 4. Roof snow load shall be the larger of 15 psf or the snow load determined in accordance with ASCE 7. Ground snow load shall be determined from Figure 7-1 in ASCE 7.
  - 5. Wind loads shall be in accordance with ASCE 7 for wind exposure category C, and basic wind speed of 90 mph (see Figure 6-1 in ASCE 7).
  - 6. Horizontal and vertical seismic loads shall be in accordance with ASCE 7 and the site class as determined in the soil investigation report. Importance Factor I = 1.50. Response Modification Coefficient R = 3.0 in accordance with ASCE 7.
- D. Combination of Loads The effect of combination of loads shall be considered in accordance with the latest version of AWWA D107 effective at the time of the bid.
- E. Foundation Design The foundations shall be designed by the Contractor to safely support the structure based on the recommendations of the geotechnical report. Foundations shall be sized in accordance with AWWA D107, Section 7, "Foundations." Foundation design selected by Contractor shall be at no additional cost to the Owner.
- 2.02 CONCRETE FOUNDATION The concrete foundation shall be designed in accordance with ACI 318. Minimum specified compressive strength shall be 4000 psi at 28 days. The service load reinforcement tension stress shall not exceed 30,000 psi under dead plus water load unless flexural cracking is otherwise controlled in accordance with ACI 318.
- 2.03 CONCRETE SUPPORT STRUCTURE The concrete support structure shall be designed in accordance with ACI 318. The specified compressive strength of concrete shall be as required by design, but not less than 4000 psi at 28 days. The maximum specified compressive strength of concrete for the wall and dome shall be 6000 and 5000 psi respectively.
  - A. Support Wall Support wall shall be reinforced concrete with a minimum thickness of 8 inches exclusive of any architectural relief. Wall thickness shall be provided such that the average compressive stress due to the weight of the structure and stored water is limited to 25% of specified compressive strength, but not greater

than 1000 psi. A minimum total wall reinforcement of 0.15% vertically and 0.20% horizontally shall be distributed approximately equally to each face. A minimum of 0.75% vertical reinforcement shall be provided in the top 6 ft. of the wall extending into the concrete ring beam. Minimum concrete cover for interior / exterior faces shall be 1 inch and 1-1/2 inches respectively.

- B. Tank Floor Tank floor shall be a reinforced concrete dome not less than 8 inches thick. The average compressive stress due to the weight of the structure and stored water shall not exceed 13% of the specified compressive strength, nor greater than 600 psi. Minimum total reinforcement in orthogonal directions shall be 0.40% distributed approximately equally to each face. Additional reinforcement shall be provided for stress caused by edge restraint effects.
- C. Future Structural Floor Make provisions in the analysis, design, and detailing of the support structure for one future structural floor with a minimum uniform live load of 125 psf. The future structural floor shall be a clear span design supported entirely by the concrete wall support. Adequate beam supports shall be provided in the support wall at the time of the support structure construction for a finished floor elevation 16 feet above the grade slab.
- D. Openings The effects of openings in the wall shall be considered in the design. Not less than 60% of the interrupted reinforcement in each direction shall be placed each side of the opening. Reinforcement shall extend past the opening not less than half the transverse opening dimension.

Openings wider than 3 ft. 6 in. shall be subjected to a rigorous analysis taking into account the stress concentrations and diminished lateral support that exist in the vicinity of such openings. Each side of the opening shall be designed as a column in accordance with ACI 318.

Openings 8 ft. 0 in. or wider used for vehicle access shall be strengthened against vehicle impact and local buckling by means of an internal buttress located on each side of the opening. The buttress shall consist of a thickened, reinforced concrete wall section that is integrally formed and placed with the support wall. The buttress section shall be not less than 3 ft. 0 in. wide and 6 in. thicker than the nominal wall dimension.

### 2.04 CONCRETE SUPPORT STRUCTURE / STEEL TANK INTERFACE

A. Interface Region - The interface region includes those portions of the concrete support structure and steel tank affected by the transfer of forces from the tank cone and the tank floor to the concrete support wall. This includes a ring beam and connection details. The Contractor shall provide evidence that a thorough review of the interface region has been performed. Finite element and finite difference analyses are the required methods for examining such local stresses in detail.

The geometry of the interface shall provide for positive drainage and not allow either condensate or precipitation to accumulate at the top of the concrete wall or ring beam.

B. Ring Beam - The ring beam shall be reinforced concrete with a nominal width and height of at least two times the support wall thickness. Minimum radial and circumferential reinforcement shall be 0.25%. For direct tension, reinforcement shall be provided such that the average service load stress in tension reinforcement due to the weight of the structure and stored water does not exceed 12,750 psi.

Ring beam design shall consider unbalanced forces from the steel tank cone and concrete dome, load conditions varying with water level, eccentricity of loads resulting from design geometry, and allowance for variations due to construction imperfection and tolerance.

## 2.05 STEEL TANK

- A. General The steel tank shall be all welded construction and shall be designed in accordance with AWWA D107, Section 5, "Steel Tank". The required capacity and dimensions of the tank are noted on the drawings and in this section of the specifications. All exposed lap joints shall be fully seal welded on both sides.
- B. Plate Thickness All members shall be designed to safely withstand the maximum stress to which they may be subjected during erection and operation. The minimum thickness of any steel plate shall in accordance with AWWA D107, with a minimum thickness of 1/4 in., except that plate used as a membrane over the structural concrete floor shall have a minimum thickness of 1/4 in.
- C. Roof Support All structural members supporting the roof of the steel tank shall be flat bar or sealed square tubular sections. I-beams or other sections with horizontal projections may be used if the nominal depth is 10 in. or greater. Support beams shall be seal welded to the underside of the roof plate along the entire length of the beam.
- D. Cone Conical sections of the tank that support water shall be designed in accordance with AWWA D107, Section 5, "Steel Tank."

## 2.06 APPURTENANCES AND ACCESSORIES

- A. General Accessories shall comply with the minimum requirements of the Specifications, Codes and Standards listed in 1.02, and the operating requirements of the structure.
- B. Ladder Access Ladders shall be provided from the slab on grade inside the base of the support wall to the upper walkway platform located below the tank floor. The tank floor manhole shall be provided with ladder access from the upper platform. A ladder shall extend from the upper platform, through the access tube interior to the roof. A ladder mounted on the access tube exterior shall be provided for access to the tank interior, extending from the roof manhole to the tank floor.

Ladders that terminate at platforms or landings shall extend a minimum of 48 in. above the platform elevations. A safety extension shall be provided at the top of the ladder under hatch(s). The safety extension shall be a Ladder Up Safety Post

as manufactured by Bilco or equal. The post shall extend 42-inches above the top of the ladder and be constructed of hot dip galvanized steel. Mounting hardware shall be galvanized.

Ladders located in the concrete support structure and access tube interior shall be galvanized steel. Tank interior ladders shall be coated in accordance with the tank interior coating system.

Ladder side rails shall be a minimum 3/8 in. by 2 in. with a 16 in. clear spacing. Rungs shall be minimum 3/4 in. diameter, spaced at 12 in. centers and plug welded into holes drilled in the side rails. Tank interior ladders shall be provided with 1 in. diameter rungs and 1/2 in. x 2 in. side rails and shall be fully seal welded.

Ladder shall be secured to the adjacent structure by brackets located at intervals not exceeding 10 ft. Brackets shall be of sufficient length to provide a minimum distance of 7 in. from the center of rung to the nearest permanent object behind the ladder. Ladder brackets located on the access tube exterior shall be reinforced at the access tube shell so that potential ice damage is confined to the ladder and bracket and not the access tube shell.

C. Safe Climbing Device - High strength aluminum, rigid rail safe climbing devices shall be provided on all ladders. Rails shall be center mounted and extend from 3 ft. above the ladder bottom to the top of the ladder section. Mounting brackets, fasteners and splice bars shall be provided as required for a rigid installation

Three trolleys with snap hooks shall be provided that are designed to be operated with the aluminum rail. A safety body harness with front and side rings shall be supplied for each trolley.

A caution sign shall be provided at the lowest point of access to the ladder requiring safe climbing devices. The sign shall read "CAUTION – Safety Equipment Required When Climbing Ladder". The sign shall be secured to the wall.

- D. Rest Platforms Rest platforms shall be provided at maximum 50 ft. intervals along the support wall ladder. Platforms shall be minimum 3 ft. by 5 ft. and complete with handrails, mid rails and toe plates in accordance with OSHA requirements. Grating shall be used for the walking surface and shall be suitably hinged at the ladder penetration. Platforms shall be arranged for straight run ladder and operable without removing fall prevention equipment. All components shall be galvanized steel.
- E. Platforms A 4 ft. wide upper walkway platform shall be located at the top of the support wall to provide access from the support wall ladder to the roof access ladder located on the interior of the access tube. Platforms shall be provided with handrails, mid rails and toe plates in accordance with OSHA requirements. Grating shall be used for the walking surface. All components shall be galvanized steel.
- F. Support Wall Doors

1. Personnel Door (7' x 3' Clear Span) - Door frames shall be 16-gauge with concealed reinforcement at hardware locations. Expansion type anchors for existing openings shall be installed near the top, bottom and intermediate point of each jamb to rigidly secure the frame. Doors shall be 1 3/4 in. thick insulated, reinforced, full, flush type with 18-gauge face sheets and concealed reinforcement at hardware locations. All edges shall be finished flush with watertight seams. Shop applied finish for the frame and door shall be baked on rust inhibitive primer. Field finish shall be compatible with the tank exterior. Standard hardware shall be stainless steel and include three 4 1/2 in. by 4 1/2 in. hinges, industrial duty closer and lockset.

Quantity and location of personnel door(s) shall be as shown on the drawings.

Overhead Vehicle Door (12' x 12' Clear Span) - Door installation shall be on the interior face of the support wall. The door frame shall be a steel plate fabrication suitably detailed, fastened and reinforced to accept the door. Operation shall be manual with a chain hoist. The curtain shall be formed of 22-gauge steel interlocking slats with end locks and wind locks designed for a wind loading of 20 psf. Torsion springs shall be mounted on a solid torsion rod, which is attached to an exterior mounted spring tension adjustment wheel. A 24-gauge steel hood shall be provided with a weather seal to protect the assembly. Steel brackets shall be installed to the interior face of the wall with expansion anchors which enclose and support the counterbalance assembly with sealed bearings. Steel curtain guides are mounted to the brackets. The curtain, bottom bar, brackets, guides, hood, pipe and chain shall be galvanized. Provide with locking device.

Size, quantity and location of vehicle door(s) shall be as shown on the drawings.

## G. Tank Openings

- 1. Floor Provide a 30 in. diameter manhole through the tank floor. The manhole shall be operable from a ladder located on the upper platform and shall be designed to withstand the pressure of the tank contents without leakage. The manhole assembly shall include a stainless-steel hand wheel operator and threaded components.
- 2. Roof Provide two 36 in. square weather proof access hatches on the roof of the tank. One hatch shall allow egress from the access tube to the roof. The second hatch, located adjacent to the first, shall allow access to the interior of the tank via the ladder mounted on the exterior of the access tube. The opening shall have a minimum 4 in. curb. Provide aluminum covers with a 2 in. down turned edge, stainless steel hardware, hold open arm and a locking mechanism.
- H. Access Tube Provide a minimum 60-inch diameter centrally located access tube through the steel tank to provide access to the tank roof from the upper walkway platform. The access tube shall incorporate a 2 in. by 2 in. channel to collect

condensation that may form on the interior surface. A flexible 3/4 in. PVC hose complete with backflow preventer shall drain the channel to the overflow pipe.

- I. Roof Railing A 42 in. high roof handrail shall be provided to enclose all centrally located roof accessories. The roof railing shall be a minimum of 18 ft. in diameter.
- J. Rigging Access Provide a 24 in. x 36 in. opening at the top of the support wall. This opening shall be accessible from a platform and shall provide access to the exterior rigging rail located at the tank/support wall intersection. The access opening shall be provided with a hinged stainless-steel cover or a removable vent in accordance with 2.06.M.2.

A minimum 24 in. diameter opening shall be provided on the tank roof to provide access to the tank interior rigging rail.

K. Rigging Rails – Provide permanently installed rigging rails suitable for rolling trolleys at the interior of the tank at the wall/roof and access tube/roof connections. Provide an exterior rigging rail at the base of the tank adjacent to the support structure.

# L. Piping

1. Inlet and Outlet Piping - Provide a 24-inch diameter inlet and outlet pipe that extends from the base of the support structure to the tank floor elevation. Provide a minimum 6 in. high removable silt stop where the inlet/outlet pipe enters the tank. The bottom capacity level of the tank's operating range shall be at or above the elevation of the top of the silt stop. Pipe material within the support structure shall be Schedule 10S Type 304L stainless steel. Piping below the grade slab shall be flanged cement lined ductile iron suitably restrained to prevent movement. Piping below the grade slab shall be 30-inch cement lined ductile iron suitably supported and restrained to prevent movement.

The inlet/outlet pipe shall be designed to support all related static and dynamic loads. Suitable galvanized steel brackets, guides and hangers shall be provided on the support wall and tank floor at intervals not exceeding 20 feet.

The inlet/outlet pipe shall be designed and constructed to accommodate any differential movement caused by settlement and by thermal expansion and contraction over the range of extreme temperature differences expected for the support wall and pipe. The required flexibility shall be provided by an expansion joint located near grade in the vertical section of pipe.

Overflow Pipe - Provide an overflow pipe properly sized based on the max fill/withdraw rates, Contractor shall submit calculations for overflow sizing to the Engineer for review. The top of the overflow shall be located within the tank at the overflow elevation. It shall run vertically beside the central access tube and extend through the tank floor, at which point it shall turn 90° and run under the tank floor to the support wall. This horizontal run shall be sloped to drain. The pipe shall then turn 90° and run vertically beside the

support wall to grade. A base elbow shall direct the overflow through the support wall, where the pipe shall be terminated with a flap valve. Pipe material within the support structure shall be Type 304L (minimum 11 gauge) stainless steel. If the top of overflow is located above top capacity level, the tank shall be designed for the additional capacity provided by the difference.

The entrance to the overflow pipe shall be designed for the maximum inlet flow rate specified in 1.03B. The design shall be based on the water level cresting within 6 in. above the overflow elevation. A conical weir shall be provided if the entrance capacity of the overflow pipe diameter is not adequate. A vortex prevention device shall be used.

The overflow shall be designed to support all related static and dynamic loads. Suitable galvanized steel brackets, guides and hangers shall be provided on the support wall and tank floor at intervals not exceeding 20 ft. The overflow pipe and weir section within the tank shall be carbon steel and supported by the central access tube.

The overflow pipe shall be designed and constructed to accommodate any differential movement caused by settlement and by thermal expansion and contraction over the range of extreme temperature differences expected for the support wall and pipe. A layout with sufficient upper offset to accommodate differential movement is acceptable. If this method is not applicable, the required flexibility shall be provided by an expansion joint located near grade in the vertical section of pipe.

The overflow pipe shall penetrate the support wall approximately 1 ft. above grade and discharge through a flap valve onto the concrete splash pad.

3. Stainless Steel Requirements - Pipe and fittings shall be Type 304L stainless steel fabricated from material meeting the requirements of ASTM A-240. Fabrication, inspection, testing, marking and certification of pipe and fittings shall be in accordance with ASTM A-778 and A-774 respectively. All fittings less than 18 inches shall be smooth flow, fittings larger than 18 inches may be of five section miter construction. Backing flanges shall be in accordance with ASTM A285-C drilled to ANSI B16.5 Class 150. Pipe, fittings and welds shall be cleaned and passivated.

Pipe, fittings and flange thickness shall be in accordance with the manufacturers certified pressure rating for the applicable service pressures. The design pressure rating shall be minimum 125 psi for piping located within closed or valve sections.

- 4. Tank Drain A tank drain shall be provided to completely drain the tank contents if the inlet/outlet pipe does not intersect the low point of the tank. A four-inch drain pipe located at the low point of the tank floor shall be fitted with a threaded plug and tee handle.
- M. Ventilation

1. Tank Ventilation - A tank vent shall be provided, located centrally on the tank roof above the maximum weir crest elevation. It shall consist of stainless steel or aluminum components, including a support frame, screened area and cap. The support shall be fastened to a flanged opening in the tank roof. The vent cap shall be provided with sufficient overhang to prevent the entrance of wind driven debris and precipitation. A minimum of 4 in. shall be provided between the roof surface and the vent cap.

The tank vent shall have an intake and relief capacity sized to prevent excessive pressure differential during the maximum flow rate of water, either entering or leaving the tank. The overflow pipe will not be considered as a vent. The maximum flow rate of water entering the tank is specified in 1.03B. The maximum flow rate of water exiting the tank shall be calculated assuming a break in the inlet/outlet at grade when the tank is full. The vent shall be provided with an insect screen. Vent capacity shall be determined based on open area provided by the screen.

In addition to the tank vent, a pressure/vacuum relief mechanism shall be provided that will operate in the event of vent failure. The mechanism shall be designed to return automatically to its original position after operation. The pressure/vacuum relief mechanism shall be located on the tank roof above the maximum weir crest elevation, and may be incorporated in the vent assembly.

2. Support Structure Ventilation - Ventilation within the support structure shall comply with the governing building code requirements, based on occupancy classification. As a minimum, one louvered vent shall be provided at the top of the support wall. This vent shall be accessible from the upper platform and may also be designed to provide access to the exterior rigging rails located at the tank/support wall intersection. Vents shall be accessible from the interior ladders, platforms or floors provided. Vents shall be stainless steel or aluminum and provided with a removable insect screen.

## N. Interior Floors

1. Slab on Grade - Provide a 6 in. thick, 3500 psi concrete floor slab in the base of the support structure. The slab shall be supported on compacted granular fill and shall be reinforced with #4 reinforcing steel at 12 in. centers each way. Provide 1/2 in. expansion joint between floor slab and support wall and at pipes and supports that extend through the floor. Place cap strip and sealant over the expansion joint. The slab shall be sloped at 0.5% toward the truck door for drainage.

## O. Level Monitoring

1. General - Provide three 3/4 in. couplings welded to the inlet/outlet pipe 5 ft. above grade. Each coupling shall be provided with a stainless-steel nipple and an isolation valve.

- 2. Pressure Gauge Provide a pressure gauge in accordance with ASME B40.1 Grade 2A. The dial shall be 4 1/2 in. diameter with black markings on white background. Pressure range is 0-100 psi.
- P. Lightning Protection Provide a lightning protection system for the elevated tank structure and any roof mounted equipment that may be damaged by lightning.

Minimum requirements include two 28 strand by 14-gauge copper conductors bonded to the steel tank 180 degrees apart. The conductors shall be fastened to the interior support wall at 3 foot minimum spacing, and shall terminate with buried 5/8-inch diameter by 8-foot-long copper clad ground rods.

Lightning protection for obstruction lights shall consist of an air terminal mounted on the support and formed to fit around the fixture. The 1/2-inch diameter copper air terminal shall extend a minimum of 10 inches above the light fixture and shall connect to a copper conductor that terminates in a bonding plate secured to the tank roof.

2.07 ELECTRICAL AND LIGHTING - Electrical work shall be in accordance with Division 16. Obstruction lighting shall be provided in accordance with FAA standards. The obstruction light shall be centrally located on the roof of the tank above all permanent installations. It shall be a steady burning, dual fixture type with a lamp-out relay switch. The fixture shall be weather sealed, corrosion resistant, with aluminum base and housing. Red globes with 116-watt clear traffic signal lamps rated at 8000-hour life shall be provided. A pilot light located near the electrical panel shall be provided to indicate when the primary bulb has failed.

Interior Waterproof Light Sockets - Type Roughlite 90 (42 watt), or approved equal, with rigid conduit, wiring and switch shall be provided inside the support structure and access tube. There shall be one light located at the top of the access tube, one light at the lower end of the access tube above the walkway opening, one light at each of the support structure ladder rest platforms, and one light at the base of the support structure. Total number and location of lights shall be as shown on the drawings.

Exterior Lights - Shall be high pressure sodium Lumark HP-GP-35-H-120V-LL-PE-TR-WG or approved equal and shall be installed where noted on the drawings including equipment, fixtures, conduit, wire, installation and labor. All wiring and conduit for this installation shall be run on the interior of the tank pedestal.

2.08 STEEL TANK PAINTING - Refer to Section 09900 for tank coatings. Galvanized, stainless steel and concrete surfaces are not coated. All other surfaces shall be coated per Section 09900.

## 2.09 SOURCE QUALITY CONTROL

- A. Tests Review mill test certifications of all steel plate, structural components and reinforcement to ensure compliance with specification requirements.
- B. Inspections Provide inspection of shop fabricated components in accordance with AWWA D107, Section 9, "Inspection and Testing".

### PART 3: EXECUTION

#### 3.01 FOUNDATION

- A. Excavation The foundation bearing surface and excavation shall be inspected by a representative of the geotechnical engineer prior to foundation construction. Verification of the applicable design and construction recommendations is required. The geotechnical engineer shall be retained by the Contractor. After verification of the foundation bearing surface, provide a 2 in. thick concrete working slab within the lower excavation limits. Grade the site to prevent runoff from entering the excavation.
- B. Concrete Construction For shallow foundations, reinforcement placed adjacent to a concrete working slab shall have a 2 in. minimum cover, and shall be supported by precast concrete block, metal or plastic bar supports.

The sides of foundations shall be formed using any suitable system conforming to ACI 318. Earth cuts shall not be used as forms for vertical surfaces. Forms shall be provided on top sloping surfaces steeper than 2.5 horizontal to 1 vertical. Straight form panels may be used to form circular foundation shapes. The minimum design radius shall be maintained at all sections.

- C. Finish Formed surfaces shall have a smooth form finish when exposed and a rough form finish when not exposed. Unformed surfaces shall have a troweled finish when exposed and floated finish when not exposed.
- D. Void Mitigation a void mitigation program shall be implemented for shallow foundation designs, as detailed in the Geotechnical Investigation report. If the Contractor elects to design a shallow foundation, the recommendations in the Geotechnical Investigation shall be followed for void mitigation. Voids shall be filled with Class S concrete.

### 3.02 CONCRETE SUPPORT STRUCTURE

A. Architectural Concrete Construction - The exposed exterior surface of the concrete support wall is designated architectural concrete. The concrete and formwork requirements of this section shall be strictly enforced to ensure concrete of the highest practicable architectural standard. Formwork design, installation and removal shall comply with the minimum requirements of ACI 318, ACI 117 and the applicable requirements of ACI 347, except as modified by this Section.

Attention shall be given to ensure the same concrete design mix is used throughout the support wall. The proportion, type and source of cement and aggregates shall not be changed. Uniform moisture content and placing consistency shall be maintained.

Placement is crucial to achieving architectural concrete. All wall concrete shall be placed vertically and directly inside the reinforcement cage with drop chutes to prevent form splatter and the resulting surface finish variations. Placement methods that introduce concrete horizontally through wall reinforcement are strictly prohibited.

Support wall reinforcement shall be installed with plastic supports. Maximum spacing of supports for welded wire fabric shall be 5 ft. centers, horizontal and vertically. Forming systems shall be designed with the provision of ties and bracing such that concrete components conform to the correct dimensions, shape, alignment and elevation. Embedded items shall be properly positioned and secured. Form surfaces shall be thoroughly cleaned of concrete residue and coated with a release agent prior to placing reinforcement. Do not allow excessive release agent to accumulate on the form surface. Steel forms shall be coated with a non-staining, rust preventative form oil or otherwise protected. Steel formwork with rust stains and damaged surfaces shall not be used.

Support wall concreting shall incorporate segmented placement procedures. Temporary vertical bulkheads shall divide the wall pour into segments corresponding to a single truckload of concrete. The bulkheads shall be located at rustications, braced rigid and tight to maintain vertical alignment under concrete load. Wall segment concrete shall be placed vertically and continuously to full form height from a single truck load of concrete. Vertical pour rate shall be a minimum of 15 feet per hour. Placement from multiple loads is not permitted. Temporary bulkheads shall not be removed until adjacent concrete is placed.

The forming system for the pedestal wall shall be fully engineered and detailed with procedures to meet the increased demands of architectural concrete. The support wall shall be constructed with a jump form process using form segments prefabricated to match the wall curvature. Concrete pour height shall be a minimum of 4 ft. and a maximum of 10 ft. Form panels shall be designed for lateral pressures associated with full height plastic concrete head and eccentric loads resulting from the segmented wall pour procedure.

Form panels shall extend the full height of the concrete pour using only vertical panel joints. Form system shall be designed to lap and be secured to the previous wall pour. The space between the form and the previous pour shall be sealed to prevent grout leakage. Wall forms shall incorporate a positive means of adjustment to maintain dimensional tolerances specified. Wall forms shall be adjusted for vertical plumb and circularity and locked into position with through wall form ties prior to concrete placement. Working platforms that allow safe access for inspection and concrete placement shall be provided. Form surfaces shall be steel, plastic or fiberglass coated material.

The form system shall incorporate a uniform pattern of vertical and horizontal rustications to provide architectural relief to the exterior wall surface. Rustication strips shall be sealed to the form face to eliminate the grout leakage that results in broken corners, color variations and rock pockets. Broken edges and chamfers will not be accepted. All construction joints and panel joints shall be located in rustications. Vertical panel joints shall be sealed using closures which combine with the form pattern to eliminate grout leakage and panel joint lines. All joints shall be grout tight. The vertical and horizontal rustications shall be proportioned and combined to impart a symmetrical architectural pattern to the completed structure. Form ties shall be located in a uniform pattern. No architectural form treatment is required on the interior surface.

Wall forms shall not be disturbed or removed until the concrete has attained sufficient strength to prevent forming operations or environmental loads from causing surface damage or excessive stress. Support wall concreting operations shall occur a maximum of once per day. Forms are to be removed and the concrete finish inspected prior to the subsequent placement of the next wall pour. Multiple form movements and concrete placements within a day are not permitted Form removal shall be based on early age concrete strength testing. The minimum concrete strength shall be established by the Contractor, based on an analysis of stress at critical stages throughout the forming and concrete operations. Early age concrete testing shall be in accordance with ACI 228.1R-95. Pull Out testing in accordance with ASTM C 900-99, Maturity Method testing in accordance with ASTM C 1074-93, or field cured cylinders compressive strength tested in accordance with ASTM C 172 are the acceptable methods to determine early concrete strength.

The structural floor system shall be designed to support all temporary construction loads. Adequate shoring and bracing shall be provided to transfer loads without appreciable movements. Shoring and forms for the structural dome slab shall remain in place until the concrete has gained sufficient strength to carry the floor weight without damaging deflections. A system of precast segments, concreted and structurally tied together can be used in lieu of cast in place.

In periods of cold weather as defined by ACI 306, concrete surfaces shall be protected in accordance with recommendations until the component attains 35% of the specified compressive strength. At this time, protection may be removed subject to the allowable temperature differential. A reasonable temperature differential shall be defined, based on component thickness and restraint conditions.

- B. Finish Provide a smooth form finish without rub for the interior and exterior support wall. Tie holes shall be plugged using grout on the interior and manufactured plugs on the exterior which match the color of the cured concrete as closely as possible. Provide a light sandblast to the exposed exterior concrete support wall surface.
- C. Dimensional Tolerances Support structure concrete construction shall conform to the following:

#### Variation in thickness:

wall3.0% to +5.0%
dome6.0% to +10%
slab floor3.0% to +5.0%
Support wall variation from plumb:
in any 10 feet of height1 inch
in any 50 feet of height2 inch
maximum in total height3 inches
Support wall diameter variation0.4%
not to exceed 3 inches
Dome floor radius variation 1.0%
Level alignment variation:

from specified elevation ......1 inch

D. Mock Up Panel – A mock up panel shall be constructed using the proposed form surface and concrete. Minimum size will be 4 ft wide by 6 ft high. This panel shall be agreed upon by the Contractor and Engineer as the reference standard with which to judge surface quality, appearance and uniformity of texture and color for each individual lift.

Review and acceptance of formed concrete surface must be made immediately upon form removal. Succeeding pours shall not be placed until the most recent wall pour has been stripped and the form surface approved. The Engineer shall not delay the Contractor by lack of attendance. Non-attendance by the Engineer or designated representative will be understood to mean acceptance. The Contractor shall be responsible to inform the Engineer as to pour schedule.

Concrete with surface defects exceeding limitations specified herein or not meeting the standard represented by the mock-up panel shall be repaired to meet that standard.

#### 3.03 STEEL TANK

A. Welding – Welding procedures and general welding requirements shall be in accordance with AWWA D107, Section 9.5, "Welding".

No structural welding is permitted to any steel embedded in hardened concrete, unless the weld is at least 2 ft. from the embedment interface.

Grinding of weld contour shall approximate Condition "D" of NACE Standard RP0178.

- B. Fabrication Layout, cutting, forming, edge preparation and workmanship for steel tank components and fabrications shall be in accordance with AWWA D107, Section 5.4, "Fabrication and Construction Requirements."
- C. Tank Erection Steel tank erection procedures and general requirements shall be in accordance with AWWA D107, Section 5.4, "Fabrication and Construction Requirements."
- D. Tolerances Steel tank tolerances shall be in accordance with the requirements of API 650, Section 5.5. Steel cone shall be constructed to the following tolerance. The deviation from the theoretical conical surface shall not exceed 0.032  $\sqrt{RT}$ , when measured in the radial direction over length  $4\sqrt{RT}$ , where R is the radius normal to the plate surface at the point of consideration, and T is the plate thickness.
- E. Steel roof may be cone or dome in shape, designed and constructed in accordance with AWWA D107.

#### 3.04 FIELD QUALITY CONTROL

A. Concrete Testing and Inspection – The evaluation and acceptance of concrete shall be in accordance with Section 03300 of this specification.

The support wall radius, plumb and thickness shall be verified for each concrete lift at all vertical form panel joints and at a minimum of 60-degree intervals. Vertical alignment and radius shall be checked using a visible beam laser. Measurement shall be made to the outside form surface. A log of the measurements and an inspection report certified by the tank designer shall be provided to the Owner at project completion.

B. Steel Tank Testing & Inspection – Inspection procedures for the steel tank shall be in accordance with AWWA D107, Section 9, "Inspection and Testing." Radiographic inspection of full penetration butt-welded joints shall be made by an independent inspection company retained by the Contractor and acceptable to the Owner.

Erection tolerance of the steel cone in the radial direction shall be measured. Provide field measurements at 30-degree intervals.

Weld joints of plate over the structural concrete floor shall be tested for leaks by vacuum box / soap solution testing, or equivalent method prior to grouting.

#### 3.05 CLEANING

- A. Site The project site shall be kept in a clean and safe condition at all times. The Contractor shall remove all construction equipment and debris at project completion.
- B. During construction of the composite elevated storage tank, Contractor shall take all necessary precautions to ensure that no falling debris, dust, or any other materials fall on nearby properties. Any damage or staining of existing structures, on or off site, caused by the construction activities shall be immediately repaired or replaced by the Contractor.
- C. Tank Disinfection Water and sufficient pressure for flushing, cleaning, initial testing and disinfection shall be supplied by the Owner at no cost to the Contractor. Disinfection shall be in accordance with AWWA C652. Tank leakage test shall be performed during disinfection. Failed tests, including costs of additional water, etc. shall be paid for at the Contractor's expense at current City rates.

#### 3.06 PROTECTION

A. Contractor shall take all necessary precautions during the erection of the tank to protect private property and any new/existing facilities from damage or staining as a result of any construction activities (including welding, blasting, painting, etc.). Any resulting damage will be repaired at the Contractor's expense. Refer to Section 09900 for additional requirements.

#### PART 4: MEASUREMENT AND PAYMENT

#### 4.01 MEASUREMENT

A. Items in this section will be measured per lump sum or per cubic yard to include all engineering design, labor, equipment, materials and appurtenances required in this Section and on the plans for a complete and operational composite elevated storage tank.

#### 4.02 PAYMENT

- A. Elevated Storage Tank, 1.25 MG Capacity, Foundation, Concrete Pedestal, and Steel Tank, including any required items not listed in other bid items for this Section, per Lump Sum
- B. Elevated Storage Tank Grading, per Lump Sum
- C. Elevated Storage Tank Interior Paint Systems, per Lump Sum
- D. Elevated Storage Tank Exterior Paint Systems, per Lump Sum
- E. Elevated Storage Tank Exterior Logo Painting, per Lump Sum
- F. Elevated Storage Tank Inlet and Outlet Piping and Valves, per Lump Sum
- G. Elevated Storage Tank Overflow Piping and Flap Valve, per Lump Sum
- H. Elevated Storage Tank Cleaning and Disinfection, per Lump Sum
- I. Elevated Storage Tank Concrete Splash Pad, Including Excavation, Compaction, Reinforcing Steel, Formwork, and Rock Riprap, per Lump Sum
- J. Void mitigation (only to be used for shallow foundation designs), per Cubic Yard

**END OF SECTION 13210** 

#### **SECTION 15110**

#### **VALVES**

#### PART 1: GENERAL

#### 1.01 SCOPE OF WORK

A. This section covers all valves, except where specific requirements are given in other sections.

#### 1.02 SUBMITTALS

- A. Complete specifications, data, and detailed drawings covering the items furnished under this specification shall be submitted for approval in accordance with Section 01300. Catalog cuts, showing sufficient detail as determined by the Engineer, will be acceptable in lieu of detailed drawings for valves smaller than 4 inch in size and for other miscellaneous small items for which detailed drawings are not readily available.
- B. Drawings and data submitted shall include complete connection and schematic wiring diagrams for all electric motor operators, equipment, devices and controls.

#### 1.03 GENERAL REQUIREMENTS

- A. Pipe and valve purchase orders shall be coordinated to insure proper installation of the valves and piping in conformance with the specified requirements.
- B. All valves, except those which are equipped with power actuated operators or are designed for automatic operation shall be provided with manual operators.
  - 1) Wrench nuts shall be provided on all buried valves, on all valves which are to be operated through floor boxes, and where shown on the plans. All wrench nuts shall comply with Section 3.16 of AWWA C500. Not less than two operating keys shall be furnished for operation of the wrench nut operated valves.
  - Unless otherwise shown or specified, ball valves shall be lever operated. Two suitable operating levers shall be furnished for each type and size of lever operated valve.
- C. The direction of rotation of the wheel, wrench nut, or lever to open each valve shall be to the left (counter clockwise). Each valve body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open.
- D. Actual length of valves shall be within 1/16 inch (plus or minus) of the specified or theoretical length.
- E. Unless otherwise specified or shown on the plans, all 3 inch or larger buried valves shall have mechanical joint ends conforming to ANSI 21.11, all other 3 inch or

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larger valves shall have flanged ends, and all 2-1/2 inch or smaller valves shall have threaded ends. Unless otherwise specified flanges shall conform to ANSI Class 125.

#### PART 2: PRODUCTS

#### 2.01 GATE VALVES

- A. Gate valves shall be shop tested in accordance with the latest revision of AWWA C500 or C515.
- B. Resilient seated gate valves shall conform to AWWA C509, reduced wall resilient seated gate valves shall conform to AWWA C515. Approved gate valve manufacturers and models shall be as indicated on the currently approved City of Austin Standard Products List (WW-282 or WW-700).
- C. Gate valves 24-inch and larger shall be geared and shall conform to AWWA C515 and NSF 61. When necessary for proper bury depth and cover, gate valves shall be the horizontal bevel geared type. Packing or "O"-Ring seals shall be provided where geared operators are required.
- D. Exposed valves 16-inches or larger for horizontal stem installation shall be furnished with rollers, tracks and scrapers and enclosed bevel gear grease case.
- E. All valves bodies shall be hydrostatically tested to at least twice the rated working water pressure. In addition, valves shall be seat-tested, bi-directional at the rated working pressure, with seat leakage not to exceed one fluid ounce per inch of valve diameter per hour for double disc gate valves. There shall be no leakage past the seat for resilient seat/wedge gate valves. Provide certificates of testing.
- F. Exposed valves shall be furnished with Class 125 flanged ends, non-rising stem design. Flanges shall have face-to-face dimensions per ANSI B.16.1 and flanges per ANSI B.16.10. Exposed valve hardware (nuts, bolts, washers, etc.), including bonnet and cover, stuffing box, gear adaptor and joints shall be Type 304 stainless steel (unpainted) with anti-seize compound.
- G. All valves shall be marked per AWWA Standards, including name of manufacturer, size, working pressure and year of manufacture.
- H. Valve operation shall be counterclockwise. Provide permanent label showing "OPEN" and directional arrows.

#### 2.02 ALTITUDE AND SOLENOID SHUT-OFF VALVES

- A. Altitude and Solenoid Shut-off Valves shall be furnished and installed in accordance with the Plans. The valve shall be a self-contained hydraulically operated, diaphragm-actuated valve that includes a three-way solenoid pilot valve. The valve shall open or close in response to an electrical signal.
- B. Valves shall be certified to NSF/ANSI 61 and certified to be lead free per NSF/ANSI 372.

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C. The valves shall be hydrostatically and seat tested to ensure zero leakage through the valve. Test certificates must be submitted to the Engineer.

- D. Valve body and cover to be ASTM A536 Grade 65-45-12 ductile iron. Disc retainer and diaphragm washer shall be cast iron. Disc guide, seat, bearing cover, stem, nut, and spring shall all be stainless-steel. The disc shall be precision molded Buna-N (NBR), ASTM D2000-BG. The diaphragm shall be nylon reinforced Buna-N (NBR) rubber.
- E. Pilot control system body shall be Brass B283. Pilot trim shall be Brass and 303 stainless-steel. Solenoid enclosure shall be NEMA Type 1, General Purpose, and watertight.
- F. Valve connections shall be flanged per ANSI B16.42, Class 150.
- G. Interior and exterior of the valve shall be coated with an NSF/ANSI 61 approved for contact with potable water.
- H. Altitude and Solenoid Shut-off Valves shall be Cla-Val Model 210-27, or approved equal.

#### 2.03 SWING CHECK VALVES

- A. Swing Check Valves shall be furnished and installed in accordance with the Plans. The valve shall prevent backflow and be water-tight.
- B. Valves shall be certified to NSF/ANSI 61 and certified to be lead free per NSF/ANSI 372. Valves shall be designed, manufactured, tested, and certified to ANSI/AWWA C508.
- C. The swing check valves shall be hydrostatically and seat tested to ensure zero leakage through the check valve. Test certificates must be submitted to the Engineer.
- D. Valve body and cover to be ASTM A536 Grade 65-45-12 ductile iron. Valve disc shall be precision molded Buna-N (NBR), ASTM D2000-BG.
- E. Valves connections shall be flanged per ANSI B16.42, Class 150.
- F. Interior and exterior of the valve shall be coated with an NSF/ANSI 61 approved for contact with potable water.
- G. The disc accelerator shall be of one-piece construction and provide rapid closure of the valve in high head applications. The disc accelerator shall be enclosed within the valve and shall be field adjustable and replaceable without removal of the valve from the line. The disc accelerator shall be securely held in place captured between the cover and disc. It shall be formed with a large radius to allow smooth movement over the disc surface.

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H. Optional features such as a backflow actuator, mechanical position indicator, and pre-wired limit switch are not required, unless indicated on the plans.

I. Swing check valves shall be Val-Matic Surgebuster Swing Check Valve Series 7200, or approved equal.

#### PART 3: EXECUTION

#### 3.01 SETTING OUTSIDE VALVES

- A. Each valve which is installed in direct contact with earth backfill shall be provided with a valve box of such type and design that surface loads, impact or shock will not be transmitted through the box to the valve.
- B. Valves and valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with the finished grade. After being placed in proper position, earth shall be filled in around each valve box and thoroughly tamped for a distance on each side of the box of 4 feet at the top of the pipe and 2 feet measured at the top of the trench.
- C. Each valve shall be inspected before installation to ensure that all foreign substances have been removed from within the valve body, and shall be opened and closed to see that all parts are in first-class working condition. Geared valves shall be inspected to see that the gears are properly lubricated.

#### PART 4: MEASUREMENT AND PAYMENT

#### 4.01 GENERAL

A. No separate measurement or payment will be made for valves unless specifically included on the Bid Form. If specifically included on the Bid Form, valves will be measured and paid per Each, otherwise they shall be included in the lump sum price for other associated bid items.

**END OF SECTION 15110** 

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#### **SECTION 15640**

## JOINT BONDING AND ELECTRICAL ISOLATION

#### PART 1 **GENERAL**

#### 1.01 **SECTION INCLUDES**

- A. Joint bonding requirements for electrical continuity of pipelines as required on the plans.
- B. Electrical isolation devices for installation at any interfaces between dissimilar metals.

#### 1.02 RELATED SECTIONS

A. Not Used.

#### **REFERENCES** 1.03

- ASTM D 1248 Polyethylene Plastics Molding and Extrusion Material.
- В. AWWA C207 - Steel Pipe Flange for Waterworks Service.
- C. AWWA M9 Manual Concrete Pressure Pipe.
- D. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings.
- E. ANSI B16.5 - Pipe Flange and Flanged Fittings.

#### 1.04 **SUBMITTALS**

- A. Catalogue Cut Sheets: Manufacturer's catalog cut sheets shall be submitted for each item. The catalog cut sheets shall include the manufacturer's name and provide sufficient information to show that the materials meet the requirements of the drawings and specifications. Where more than one item or catalog number appears on a catalog cut sheet, clearly identify the item proposed.
- B. Test Results: Electrical continuity and flange isolation test results shall be submitted to the owner or its designated representative.

#### 1.05 QUALITY CONTROL

- A. Provide certification that all electrical continuity bonding meets the requirements of the drawings and specifications. Reference certification to applicable section of specifications and applicable standard detail.
- B. Provide certification that all pipeline isolation devices meet the published material specifications.
- C. All materials, fabrication, and installations are subject to inspection and testing by the owner or its designated representative.

#### PART 2 PRODUCTS

#### 2.01 DESCRIPTION OF MATERIALS

- A. Joint bonding and electrical isolation materials to be incorporated into the project include, but are not limited to, the following:
  - 1. Electrical continuity bonds.
  - 2. Flange isolation assemblies.
  - 3. Casing spacers.
  - 4. Casing end seals.

#### 2.02 ELECTRICAL CONTINUITY BONDS

- A. Applications: Applications for electrical continuity bonding include the following:
  - 1 Bonding across bolted joint assemblies.
  - 2. Bonding across gasketed joint assemblies.
- B. Preparation of Steel Pipe for Bonding: Bonding wires are not required for welded steel pipe. Mechanical joints, however, require the installation of bond wires across the joint as shown on the project drawings.
- D. Preparation of Ductile Iron Pipe for Bonding: Install insulated bond wires as shown on the project drawings.
- E. Electrical Bond Wires: Electrical bond wires are to be a minimum No. 4 AWG, seven stranded, copper cable with THHN insulation. Remove one inch of THHN insulation from each end of the bond wire. Exothermic weld the bond wires to the pipeline. Provide the minimum number of bond wires as shown on drawings for steel or ductile iron pipe.

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#### 2.03 FLANGE ISOLATION

- A. Required applications of dielectric flange isolation assemblies include but are not limited to selected locations where new piping is mechanically connected to existing piping.
- B. For concrete cylinder pipe, provide electrical isolation through the installation of the following materials:
  - 1. Flange connection to Lock Joint bell adapter.
  - 2. Flange connection to Lock Joint spigot adapter
  - 3. Insulating Gasket:
    - a) For piping 30 inches diameter and greater, provide Pyrox G-10 with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
    - b) For piping between 12 inches and 24 inches diameter, provide Phenolic PSI with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
    - c) Alternately, provide plain-faced phenolic gasket, as manufactured by Pipeline Seal and Insulator, Inc., or approved equal. Place phenolic gasket between two full-faced gaskets. Provide cloth-inserted rubber gasket material, 1/8 inch thick in accordance with AWWA C207. Use factory cut gaskets of proper dimensions.
  - 4. Sleeves and Washers:
    - a) For piping 30 inches diameter and greater, provide full length mylar sleeves with Pyrox G-10 washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
    - b) For piping between 12 inches and 24 inches diameter, provide full length mylar sleeves with Phenolic washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
- C. For steel pipe, provide electrical isolation through installation of the following materials:
  - 1. Insulating Gasket:
    - a) For piping 30 inches diameter and greater, provide Pyrox G-10 with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
    - b) For piping between 12 inches and 24 inches diameter, provide Phenolic PSI with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
    - c) Alternately, provide a plain-faced phenolic gasket, as manufactured by Pipeline Seal and Insulator, Inc., or approved equal. Place phenolic gasket between two full-faced gaskets. Provide cloth-inserted rubber gasket material, 1/8 inch thick in accordance with AWWA C207. Use factory cut gaskets of proper dimensions.
  - 2. Sleeves and Washers:
    - a) For piping 30 inches diameter and greater, provide full length mylar sleeves with Pyrox G-10 washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
    - b) For piping between 12 inches and 24 inches diameter, provide full length mylar sleeves with Phenolic washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.

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- D. For ductile iron pipe, provide electrical isolation through installation of the following materials:
  - 1. Insulating Gasket:
    - a) For piping 30 inches diameter and greater, provide Pyrox G-10 with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
    - b) For piping between 12 inches and 24 inches diameter, provide Phenolic PSI with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
    - c) Alternately, provide a plain-faced phenolic gasket, as manufactured by Pipeline Seal and Insulator, Inc., or approved equal. Place phenolic gasket between two full-faced gaskets. Provide cloth-inserted rubber gasket material, 1/8 inch thick in accordance with AWWA C207. Use factory cut gaskets of proper dimensions.
  - 2. Sleeves and Washers:
    - a) For piping 30 inches diameter and greater, provide full length mylar sleeves with Pyrox G-1 washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
    - b) For piping between 12 inches and 24 inches diameter, provide full length mylar sleeves with Phenolic washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
  - E. Coatings for buried isolation flanges shall be Densyl Tape system manufactured by Carboline, consisting of Densyl Mastic, Densyl Paste, and Densyl Tape, or approved equal.

#### 2.04 CASING SPACERS

- A. For piping installed in tunnels or cased crossings, install casing spacers between the piping and the casing or tunnel liner to provide electrical isolation.
- B. Inside diameter of casing or tunnel liner must be a minimum of 4 inches greater in diameter than the outside diameter of the piping. In the case of mechanically coupled piping, the casing must be a minimum of 4 inches greater in diameter than the outside diameter of the coupling at its largest point.
- C. For welded steel pipes 12-inch diameter and smaller, use injection molded polyethylene insulators, Model PE as manufactured by Pipeline Seal and Insulator, Inc. or approved equal.
- D. For all other pipe materials 12 inch diameter and smaller, use 8 inch wide steel insulators with 2 inch wide glass reinforced runners, Model C8G-2 as manufactured by Pipeline Seal and Insulator, Inc. or approved equal.
- E. For all piping greater than 12 inch diameter, use 12 inch wide steel insulators with 2 inch wide glass reinforced runners, Model C12G-2 as manufactured by Pipeline Seal and Insulator, Inc. or approved equal.

#### 2.05 CASING END SEALS

A. For all piping less than 24 inch diameter, use hard rubber seals, Model PL Link Seal as manufactured by the Thunderline Corporation or approved equal.

B. For all piping 24 inch diameter and greater, use pull-on, 1/8 inch thick, synthetic rubber end seals, Model C, as manufactured by Pipeline Seal and Insulator, Inc. or approved equal.

#### **PART 3 - EXECUTION**

#### 3.01 INSTALLATION OF ELECTRICAL CONTINUITY BONDS

- A. Inspection: Use continuous bond wires with no cuts or tears in the insulation covering the conductor.
- B. General: Attach bond wires at required locations by thermite welding process.
- C. Thermite Welding Methods: Perform thermite welding of bond wires to piping in the following manner:
  - 1. Clean and dry pipe to which wires are to be attached.
  - 2. Use grinding wheel to remove all coating, mill scale, oxide, grease, and dirt from an area approximately 3 inches square. Grind surface to bright metal.
  - 3. Remove approximately 1 inch of insulation from each end of wire to be thermite welded to pipe, exposing clean, oxide-free copper for welding.
  - 4. Select proper size thermite weld mold as recommended by manufacturer. Place wire or strap between graphite mold and the prepared metal surface.
  - 5. Place metal disk in bottom of mold.
  - 6. Pour thermite weld charge into the mold. Squeeze bottom of cartridge to spread ignition powder over charge.
  - 7. Close mold cover and ignite starting powder with flint gun.
  - 8. After exothermic reaction, remove thermite weld mold and gently strike weld with a hammer to remove weld slag. Pull on wire or strap to assure a secure connection. If weld is not secure or the bond breaks, repeat procedure with new wire or strap.
  - If weld is secure, coat all bare metal and weld metal with Kop-Coat. Cover 9. coated weld with a plastic weld cap.
- D. Post-Installation Inspection: Post-installation inspection of all electrical continuity bonds shall be made through a visual examination of each thermite weld connection for strength and suitable coating prior to backfilling. In addition, perform one or more of the following tests:

- 1. Circulate current through pipe using DC power supply. Calculate resistance through known length of pipe. Resistance must not exceed 150% of theoretical resistance for pipe and bonds.
- 2. Measure resistance through select bonded joints with a digital low resistance ohmmeter (DLRO). Resistance of 0.001 ohms or less is acceptable.
- 3. Position a copper sulfate electrode (CSE) at a stationary location adjacent to bonded pipeline. Impress a temporary current on pipe. Record the current-applied, and "instant off" pipe-to-soil measurements along the pipe relative to a stationary CSE.
  - Static potential measurements referenced to a stationary CSE must a. be nearly identical along the pipe to indicate electrical continuity.
  - "Instant off" potentials referenced to a stationary CSE must be b. nearly identical along pipe to indicate electrical continuity.
  - The difference between the "instant off" and the static potential c. referenced to stationary CSE must be equal at each point of contact to pipe to indicate electrical continuity.
- 4. If any of the above procedures indicates a poor quality bond connection, reinstall the bond.
- 5. Record results and submit to the owner or its designated representative for approval prior to backfilling.

#### Backfilling of Bonded Joints:

- 1. Perform backfilling of bonded piping in manner that prevents damage to the bonds and all connections to the metallic structures.
  - Use appropriate backfill material to completely cover the electrical a.
  - Provide protection so that future construction activities in the area b. will not destroy the bonded connections.
- 2. If construction activity damages a bonded connection, install new bond wire.

#### INSTALLATION OF PIPELINE FLANGE ISOLATION DEVICES 3.02

A. Placement: Install isolation joints at the locations shown in the test station schedule on the drawings, at all valve locations on steel pipe, and at locations where dissimilar piping materials (metals) are joined together, including at blowoff and air release leads on steel pipe.

- B. Assembly: Place gasket, sleeves, and washers as recommended by the manufacturer. Follow manufacturer's recommendations for even tightening to proper torque.
  - C. Testing: Immediately after an electrical isolation fitting has been installed, test electrical isolation effectiveness with a Gas Electronics model 601 meter, or approved equal. Fully document all test results.
  - D. Painting: Do not use metal base paints on electrical isolation devices.
  - E. Encapsulation: Encapsulate below-grade isolation joints with the Carboline Densyl tape system, or approved equal, after the isolation joint has been tested for effectiveness.

#### 3.03 TESTING OF JOINT CONTINUITY BONDS AND ISOLATION JOINTS

- A. General: After the completion of the continuity bonding of individual joints but before the pipe is backfilled, each bonded joint shall be tested for electrical continuity.
- B. A DC current shall be impressed on the pipe on one side of the joint under test using a portable 12-volt battery and a driven ground rod. The battery shall be connected such that the positive terminal is connected to the ground rod and the negative terminal is connected to the pipe section under test. The magnitude of test current is not important as long as it causes a change in pipe-to-soil potential on the section of pipe that is in the test current circuit.
- C. The pipe-to soil potential shall be measured on each side of the isolation joint using a high impedance voltmeter and portable copper/copper sulfate reference electrode with the test current "on" and "off".
- D. A joint is considered electrically continuous if the "on" and "off' potentials are the same on either side of the joint under test.
- E. This same procedure shall be used to test individual isolation joints except that the joint is considered effective if the pipe-to-soil potential is <u>not</u> the same when measured on each side of the joint when the test current is "on".

## 3.04 INSTALLATION OF CASING SPACERS

- A. Assemble and securely fasten casing spacers to the pipeline to be installed in casings or tunnels.
- B. Avoid inadvertent metallic contact between casing and carrier pipe. Place spacers close enough to ensure that the pipe is adequately supported throughout its length, particularly at the ends, to offset settling and possible electrical shorting. The end spacer must be within 6 inches of the end of the casing pipe, regardless of size of casing and pipe or type of spacer used. Install spacers on PVC pipe at the insertion line to prevent over-insertion of the spigot into the bell.

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- C. Grade the bottom of the trench adjacent to each end of the casing to provide a firm, uniform and continuous support for the pipe. If the trench requires some backfill to establish the final trench bottom grade, place the backfill material in 6-inch lifts and compact each layer.
- D. After the casing or tunnel liner has been placed, pump dry and maintain dry until the casing spacers and end seals are installed.
- E. Install casing spacers in accordance with the manufacturer's instructions. Correctly assemble, evenly tighten, and prevent damage during tightening of the insulators and pipe insertion.

## F. Insulator Spacing:

- 1. Maximum distance between spacers to be 10 feet for pipe sizes 6 inches and smaller, and 6 feet for pipe sizes greater than 6 inches.
- 2. For ductile-iron pipe, flanged pipe, or bell and spigot pipe, install spacers within one foot on each side of the bell or flange, and one in the center of the joint where 18 foot or 20 foot long joints are used.
- 3. If the casing or pipe is angled or bent, reduce the spacing.

#### 3.05 INSTALLATION OF END SEALS

- A. Assemble hard rubber Link-Seals around the pipe and slide into the annular space between the pipe and casing. Evenly tighten the bolts to provide a positive seal.
- B. Place pull-on synthetic rubber end seals on the pipe and pull over the end of the casing. Securely fasten stainless steel bands.

#### 3.06 CASING TO CARRIER PIPE ISOLATION TESTS

- A. Immediately after the pipe has been installed in the casing, but prior to connecting the line, perform an electrical continuity test to determine that the casing is electrically isolated from the pipeline. The continuity check shall be fully documented and approved by the owner or its designated representative prior to backfilling.
- B. If the electrical isolation between carrier pipe and casing is not effective, the cause shall be immediately investigated, and the situation remedied. Under no circumstances shall a shorted casing be backfilled.

#### **PART 4 - MEASUREMENT AND PAYMENT**

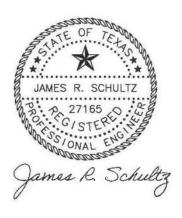
A. Except as noted, work performed and the materials furnished for this item as indicated will not be measured for payment but will be considered subsidiary to other related items of work.

END OF SECTION

# ELECTRICAL/INSTRUMENTATION SPECIFICATIONS

## SAN GABRIEL EAST ELEVATED STORAGE TANK

June 18, 2021



JRSA Engineering, Inc. 6101 W. Courtyard Dr.1-200 Austin, Texas 78730 512.452.8789 jim@jrsaengineering.com

#### PART 1: GENERAL

#### 1.01 GENERAL NOTE

- A. This Section of the Specifications together with the drawings and other applicable sections of the Specifications, including requirements of the Instruction to Bidders, Contract Agreement, General Conditions, Supplementary General Conditions and Special Conditions comprise the Electrical portion of the work.
- B. Note that the items associated with the SCADA system shall be furnished by the City of Leander's SCADA Contractor and is so be included as an allowance in the Base Bid. These items are noted in the following Scope of Work.
- C. Note that the existing antenna and radio from the existing pump building shall be moved to the elevated tank and installed there. If this is to take more than 8 hours the SCADA Contractor shall provide new radio and antenna and include the cos of those items in the Bid.

#### 1.02 SCOPE OF THE WORK

- A. The work contemplated under this Section includes the furnishing of all supervision, labor, materials, tools, transportation, services, etc., required for the complete installation and operation of the electrical work as shown on the drawings and as specified herein. The work shall specifically include, but not limited to, the following:
  - 1) Installing a feeder breaker in the existing switchboard in the pump station building.
  - 2) Installing a power panel (power center) in the elevated storage tank.
  - 3) Installing power wiring from the feeder breaker in the switchboard to the power center.
  - 4) Installing a RTU in the proposed elevated tank and installing a Cat 6 ethernet cable from that RTU to the existing RTU in the control panel at the pump building. RTU and programming to be furnished by the SCADA Contractor.
  - 5) Installing conduit from the RTU and power panel in the elevated tank to existing in-ground pull boxes near the tank.
  - 6) Installing conduit in the pump building to complete the runs of power and ethernet cables at that end.
  - 7) Electrical installations at the elevated storage tank, including interior and exterior lighting, receptacles, control wiring to the level transmitter, the fill valve and back-up level electrodes, electrical rack with a RTU panel and power panel, and providing power to equipment. RTU Panel to be furnished by SCADA Contractor and installed by Electrical Contractor.

#### PART 1: GENERAL

#### 1.01 SCOPE OF WORK

- A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish, and install all of the following conduit systems:
  - 1) Heavy wall aluminum conduit
  - 2) Nonmetallic rigid polyvinyl chloride (PVC)
  - 3) Flexible aluminum waterproof conduit
  - 4) PVC-coated rigid aluminum conduit
  - 5) PVC-coated rigid steel conduit

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Submittals: Section 01300
- B. Electrical General Information: Section 16010
- C. Wire and Cable: Section 16120
- D. Boxes and Fittings: Section 16130
- E. Grounding: Section 16450

## 1.03 REFERENCE STANDARDS

- A. ANSI/UL 1 Safety Standard for Flexible Metal Conduit.
- B. UL 5A Nonmetallic Surface Raceway and Fittings
- UL 6 Underwriters Laboratories Standard For Safety Electrical Rigid Metal Conduit -Steel
- D. UL 6A Underwriters Laboratories Standard For Electrical Rigid Metal Conduit Aluminum, Bronze, and Stainless steel
- E. UL 467 Electrical Grounding and Bonding Equipmentt
- F. UL 514B Underwriters Laboratories Standard For Safety
- G. ANSI/UL 651 Safety Standard for Rigid Nonmetallic Conduit.
- H. ANSI/UL 870 Safety Standard for Wireways, Auxiliary Gutters and Associated Fittings.
- I. ANSI C80.4 Fittings for Rigid Metal Conduit and Electric Metallic Tubing

- J. ANSI C80.5 Specifications for Rigid Aluminum Conduit.
- K. Federal Specification WW-C-540c Specification for Rigid Metal Aluminum Conduit.
- L. Federal Specification WW-C-581 Specification for Rigid Metal Steel Conduit
- M. NEC® (2008) Section 250.118(2)
- N. NEMA TC 2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80) and Fittings.
- O. NEMA TC 3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- P. NECA 102-2004 Standards for Installing Rigid Metal Aluminum Conduit
- Q. INTERTEK ETL PVC 001 Test For Evaluating Coating Adhesion Per ASTM D870 And D1151

## 1.04 ACCEPTABLE MANUFACTURERS

- A. PermaCote
- B. Kor-Kap
- C. Plasti-Bond
- D. Allied Tube and Conduit
- E. Triangle
- F. Wheatland
- G. ENGINEER Approved Equal

#### 1.05 SUBMITTALS

- A. The submittal shall comply with the requirements of Section 01300.
- B. The submittal shall include the following:
  - 1) Conduit manufacturer's name as used on this project.
  - 2) Conduit type and technical specifications.
  - 3) Couplings and fittings.
  - 4) Complete technical description of conduit coatings where applicable.

#### PART 2: PRODUCTS

#### 2.01 HEAVY WALL ALUMINUM CONDUIT

A. Heavy wall aluminum conduit shall be copper free aluminum. All couplings and fittings

will conform to this requirement.

#### 2.02 POLYVINYL CHLORIDE (PVC) CONDUIT

A. Nonmetallic rigid polyvinyl chloride shall be type EPC-40-PVC where installed underground.

## 2.03 POLYVINYL CHLORIDE (PVC) CONDUPVC COATED CONDUIT

A. The PVC coated aluminum and galvanized rigid conduit must be UL Listed. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit. Fittings and Ferrous fittings for general service locations must be UL Listed with PVC as the primary corrosion protection. All conduit and fittings must be new, unused material.

#### 2.04 FLEXIBLE CONDUIT

A. Flexible conduit shall be flexible aluminum core with liquid tight jacket. Anaconda Sealtite Type EFL, or approved equal.

#### PART 3: EXECUTION

#### 3.01 DELIVERY AND STORAGE

- A. Storage and Handling at Job Site. The CONTRACTOR shall store and handle all conduit at the job site, while such materials are awaiting installation, in conformance with the following:
  - 1) Store conduit and accessories in an area protected from weather, moisture or possible damage.
  - 2) Do not store materials directly on the ground.

#### 3.02 HEAVY WALL RIGID ALUMINUM CONDUIT

- A. Heavy wall rigid aluminum conduit shall be used for all conduits installed above ground unless otherwise noted.
- B. No trade size shall be smaller than 3/4-inch.
- C. A conduit's ends shall be cut square with a saw and reamed. Threads shall be cut to effect full thread joint engagement. No running threads are permitted.
- D. Pull boxes shall be installed in appropriate intervals for long conduit runs.
- E. Exposed rigid conduit shall be installed parallel to structural members and surfaces and multiple runs in the same direction shall be parallel with symmetrical bends.
- F. All conduits shall be installed clear of structural openings.
- G. Every necessary measure shall be taken to prevent the entry of dirt, stones, trash or

- water in the conduit system.
- H. Future conduits shall be capped with threaded cap if exposed, or terminated in equipment or by galvanized couplings plugged flush with the structural surfaces if concealed. Provide all future conduits with a 0.125 inch nylon fish cord pull string.
- I. Where drawings indicate future equipment, the concealed portions of conduits shall be provided unless shown otherwise on the drawings.
- J. Minimum separation of twelve inches shall be maintained between hot pipes and electrical conduits.
- K. Where conduits penetrate lift station wetwell, seal the open space between the conduit and wall with an approved waterproofing sealant.
- L. Conduits 1-inch or less may be installed between reinforcing steel in concrete walls and slabs and if there is only 1 layer of reinforcing steel in slabs, the conduits shall be placed under the reinforcement, unless otherwise directed by the structural Engineer.
- M. Structural members and reinforcing steel shall not be cut, burned or damaged in any way. Holes cut through existing floors and walls shall be neatly repaired with zinc-coated pipe rings placed on conduits at entry points.
- N. For above ground runs of conduits space supports not more than 5 feet apart and install with the runs parallel or perpendicular to walls and structural members. Use right angle turns and symmetrical bends. Do not use diagonal runs except to avoid two 90 degree bends. Do not locate conduit so as to reduce the strength of structural members. Install supports within 24" of each fitting, bend or outlet box.
- O. Support and secure groups of conduits on wall hangers using toggle bolts in hollow masonry, expansion bolts in concrete or solid masonry, machine screws on metal surfaces and wood screws on wood construction. Space conduits from mounting surfaces using conduit clampbacks. Provide plastic sleeves for conduits passing through masonry or concrete. Single conduits shall be supported by one-hole malleable clamps.
- P. Where rigid conduits enter sheet metal boxes, secure with lock nuts and bushings.
- Q. Enter outside electrical enclosures from the bottom, unless shown otherwise on the Plans. Terminate conduit connections to exterior sheet metal cabinets and enclosures with Myers Scru-Tite, or equal, hubs.

#### 3.03 POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Schedule 40 PVC conduits shall be installed underground. All penetrations out of ground shall be made with PVC coated aluminum elbows.
- B. No PVC conduit shall be used in any location where it is exposed to direct sunlight, extreme heat, or within the building.

#### 3.04 FLEXIBLE CONDUIT

- A. Use flexible conduit to connect to motors, solenoid valves, transformers and any other equipment subject to vibration.
- B. Maximum length not to exceed 18 inches.

#### 3.05 PVC-COATED CONDUIT ALUMINUM

- A. Follow applicable specifications for underground conduits.
- B. Install with any special tools recommended by the manufacturer in the manner recommended. Do not use tools which will mar the PVC coating.
- C. Patch any small nicks or abrasions in the PVC coating immediately upon discovery of the same. Replace any sections which, in the opinion of the Engineer, are badly damaged. Use touch up compound recommended by the conduit manufacturer.
- D. Use only PVC-coated fittings and supports.
- E. The conduit shall be aluminum inside and out.
- F. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.
- G. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).
- H. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
- I. Mark 9 Condulets, 1/2" through 2" diameters, shall have a v-seal tongue-in-groove gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours shall be available. Mark 9 Condulets shall be supplied with plastic encapsulated stainless steel cover screws.
- J. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.
- K. Independent certified test results shall be available to confirm coating adhesion under the following conditions:
  - 1) The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
  - 2) No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).

- 3) The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.
- L. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. PVC-coated galvanized conduit should not be coupled with PVC-coated Aluminum. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit.

#### 3.06 PVC COATED CONDUIT GALVANIZED STEEL

- A. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.
- B. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.\
- C. Form 8 Condulets, 1/2" through 2" diameters, shall have a v-seal tongue-in-groove gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours shall be available. Form 8 Condulets shall be supplied with plastic encapsulated stainless steel cover screws
- D. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).
- E. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.
- F. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.
- G. Independent certified test results shall be available to confirm coating adhesion under the following conditions
  - 1) Conduit and condulet exposure to 150°F (65°C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D1151)
  - 2) The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
  - 3) No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
  - 4) The exterior coating bond shall be confirmed using the methods described in

Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.

H. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit. Any deviation will require approval of the specifying engineer or owner and shall meet all the performance standards specified herein American Society for Testing and Materials (ASTM) and Underwriter Laboratories (UL). All performance standards require verification by a nationally recognized testing agency

#### 3.07 UNDERGROUND INSTALLATION

- A. Bury underground conduit a minimum of 24 inches below grade, unless indicated otherwise.
- B. Provide a minimum of 3" of separation between conduits or 7-1/2" on center, whichever is greater.
- C. CONTRACTOR shall be responsible for excavating, draining, trenching, backfilling and removing excess earth in connection with installation of underground conduit.
- D. Waterproof all underground conduit joints in accordance with the manufacturer's recommendation.
- E. Provide sand bedding under the conduit and a sand cover over the top of the conduits. Place compacted backfill over the sand layer. The backfill shall be free of any rocks and debris larger than 1/2" measured in any direction.
- F. Backfilling shall be done in such a manner that voids will be minimized. Excess soil shall be piled on top and shall be well tamped. All rock and debris shall be removed from the site.
- G. Install a warning tape the entire length of each conduit run. Locate tape 12 inches above the conduits. Tape is to be 4 mil polyethylene, 6 inches wide, with metallic lining and clear polyethylene backing, with the legend "CAUTION ELECTRIC LINE BURIED BELOW." Seton Style No. 6ELE, or approved equal.
- H. Provide a reinforced concrete encasement where indicated or otherwise required. Concrete to be 3000 psi/28 day strength per ASTM 039-44. Sprinkle a red admixture "Sonabrite Red" by L. Sonneborn Sons, Inc., or equal, on top of the concrete to fully cover.
- I. Stagger joints in concrete encasement a minimum of 6 inches vertically.
- J. Use approved separators and chairs installed a maximum of 4 feet on centers. Securely anchor conduit to prevent movement during concrete placement
- K. Provide a minimum 12" separation horizontally and vertically between power and signal conduits.

L. Make transition from PVC to rigid aluminum conduit where conduit leaves the ground. Transitions shall consist of a PVC-to-rigid aluminum adapter and a 90 degree PVC-coated rigid aluminum bend. Continue coating for a minimum 6 inches above grade unless otherwise specified.

**END OF SECTION** 

#### PART 1: GENERAL

#### 1.01 SCOPE OF WORK

A. The work performed under this section consists of providing labor, material, tools, equipment and related items required to furnish, install and place into operation all wire and cable systems.

#### 1.02 PAYMENT

A. No separate payment shall be made for labor or material under this item. All costs shall be included in the lump sum or unit prices shown in the proposal.

#### 1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 16010: Electrical General Provisions

B. Section 16110: Conduits

C. Section 16450: Grounding

#### 1.04 REFERENCE STANDARDS

- A. ANSI/UL 83 Thermoplastic-insulated Wires
- B. ICEA S-61-402 (NEMA WC5) Thermoplastic Wire and Cable for the Transmission and Distribution of Electrical Energy
- C. National Electrical Code

#### 1.05 DELIVERY

A. Wire and cable shall be delivered in unbroken packages bearing UL and manufacturers' labels and showing date of manufacture and maximum allowable voltage.

#### PART 2: PRODUCTS

#### 2.01 600 VOLT INSULATION

A. The power and/or control cable shall be single-conductor, soft drawn, annealed copper, with type XHHW2 insulation, 90 degrees C in dry and wet locations, unless otherwise noted. However, note that the ampacity for 75 degree C wire as tabulated in the National Electrical Code shall be used throughout in determining proper wire size.

#### 2.02 INSTRUMENT WIRE

A. Twisted pair 16 AWG copper conductors (7 strand, Class B); 15 mil 105 deg. C PVC primary insulation rated not less than 300 volts; color coded; 1.25 mil aluminum Mylar tape shield; 20-gauge, 7-strand tinned copper drain wire; 35 mil FR PVC jacket.

#### PART 3: EXECUTION

#### 3.01 WIRE AND CABLE RATED 600 VOLTS AND BELOW

- A. Color-coded wire shall be used on 600 volts and below.
- B. An equipment grounding wire run in conduit shall have an identifying green covering. Ground conductor shall be sized per NEC 250-94 and 250-95. Minimum service ground shall be #6 AWG.
- C. A green 600 volt conductor used for grounding purposes with single conductor cables of higher voltage requirements will be permitted.
- D. Conductor terminations No. 8 AWG and smaller shall be made with pressure-connected lugs, Buchanan "Termend" or equal. Conductor terminations larger than No. 8 AWG shall be made with solderless, compression-type copper terminals equivalent to Burndy type YA-L. Compression shall be made with a die set that will make a circumferential crimp. Wire strands shall be thoroughly cleaned before lug is applied.
- E. Bolted connections for electrical conductors without noncorrosive surfaces shall be thoroughly cleaned and tinned or covered with a light film of commercial paste to prevent oxidation.
- F. Where mechanical assistance is used for pulling conductors, a wire pulling compound, Polywater J, or equal, having inert qualities that do not harm the wire insulation or covering shall be applied to the conductors before they are pulled into raceways. The interior of all raceways shall be free from grease, filings or foreign matter before conductors are pulled.
- G. No wire smaller than No. 12 shall be installed except as furnished with standard packaged equipment or specified herein for low voltage control systems or fixture wiring. No. 14 may be used for control wiring where adequately protected by properly sized fuses.
- H. All wiring shall be run in conduits or raceways except in special cases. No wire shall be installed until the conduit system is completed and the construction work has progressed beyond the stage where the wire may be damaged.
- I. Where the capacity of a single feeder is so great as to require parallel conductors in more than one conduit, each conduit must contain the same number and length of conductors in all phases (legs) of the feeder, including any neutral conductors.

- J. In circuits of 600 volts and below, control wiring may be pulled in the same conduit with the power wiring if the control wiring is rated for the same voltage as the power wiring and if the conduit size is adequate. Generally, motors 30 HP and larger shall have separate conduit systems for the motor leads and control wiring. Under no circumstance shall circuits above 600 volts and below 600 volts be pulled in the same conduit or the same cable tray without a metal barrier between.
- K. Wiring shall be continuous between outlets. Keep splices to a minimum. Splice only in accessible junction boxes. Make splices to carry full capacity of conductors without perceptible temperature rise. Do not pull splices into conduit.
- L. Wiring shall be tagged with heat shrinkable Brady Wire Markers or equal at panel-boards, with suitable numbers for use in identification. All control wiring shall be tagged likewise.
- M. One conductor of each lighting circuit shall be identified. The identified conductor shall be connected to the screw shell of the lamp socket.
- N. No more than three lighting circuits shall be installed in any conduit for 4-wire, 3-phase systems, or two circuits for 3-wire single-phase systems. Each of the circuits shall be of a different phase.
- O. Identify all wires in accordance with Section 16010.
- P. Continuity tests shall be performed on all power and control circuit conductors using an ohmmeter and megohmeter. Proper phasing connections shall be verified.
- Q. The manufacturer's recommended pulling tension shall not be exceeded when installing wiring.

#### 3.02 INSTRUMENTATION WIRING

- A. Analog signals shall be separated physically from control and power wiring. A separate conduit shall be used for each.
- B. Twenty-four and 48 Vdc shall be used in separate conduits from 115 VAC wiring.
- C. Wiring shall be arranged neatly with terminations located directly opposite the terminals. Wire loops shall be not less than 6 inches long in each outlet box. Frayed terminals and exposed wire shall be taped.
- D. Shields shall be grounded at only one end of each cable run. Shields shall be continuous throughout the run. Jumpers shall be provided at terminals blocks to ensure continuity.
- E. Brady or equal heat shrink wire markers shall be provided to identify each wire at both the terminal block and the device, i.e., at both ends.

## **SECTION 16120 WIRE AND CABLE**

#### F. Color code as follows:

- Line and load circuits AC or DC power Black 1)
- AC control circuits Red 2)
- 3) DC control circuits - Blue
- Interlock control circuits on the panel energized from an external 4) source - Yellow
- Equipment grounding conductors Green Neutral conductor White 5)
- 6)

**END OF SECTION** 

#### PART 1: GENERAL

#### 1.01 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish, and install all junction boxes, pull boxes, outlet boxes and ceiling boxes installed outdoors and indoors.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Electrical General Provisions: Section 16010
- B. Conduits: Section 16110
- C. Grounding: Section 16450

#### 1.03 REFERENCE STANDARDS

- A. ANSI/NEMA OS1 Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
- B. ANSI/NEMA OS2 Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
- C. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. ANSI/UL 514 Electrical Outlet Boxes and Fittings.
- E. ANSI/NEMA FB-1 Fittings and Supports for Conduit and Cable Assemblies.
- F. FS W-C-582 Conduit, Raceway, Metal and Fitting, Surface.
- G. NEMA TC3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- H. ANSI/UL5 Safety Standards for Surface Metal Raceways and Fittings.
- National Electrical Code.

#### PART 2: PRODUCTS

## 2.01 MATERIALS

- A. Pull and junction boxes installed outdoors shall be Nema 4X 304SS except that boxes in Class 1, Division 1 hazardous areas shall be Nema 7.
- B. The Contractor shall size all pull and junction boxes in accordance with the requirements of the National Electrical Code.
- C. Use standard threaded type couplings and connectors, galvanized outside and

- inside by hot dipping. Do not use set screw type connectors.
- D. For rigid bushings 1.25 inch and larger, use the insulating type. Use double locknuts and bushings on smaller conduits. Use O.Z. Type BLG grounding bushings at panel boards, motor control centers and control panel entries for conduits 1.25 inch and larger.
- E. Use galvanized malleable iron conduit clamps and supports appropriately sized for each application. Use conduit clampbacks to provide air space between the conduit and the surface to which it is mounted.
- F. Use threaded malleable iron conduit fittings with gasketed cover for rigid steel. Crouse Hinds Obround Series, or equal.
- G. Device or utility boxes shall be of unit construction of a size required for the number of switches or outlets required. No sectional device boxes will be permitted.
- H. All boxes in exposed conduit runs shall be Crouse Hinds Type FS or FD, as applicable, or approved equal, with threaded conduit entries.
- I. Do not use switch boxes as junction boxes.
- J. Coordinate final location of boxes with other trades to avoid any conflicts.
- K. Support boxes independently of conduit.
- L. Coordinate location of boxes to avoid conflicts with architectural and mechanical construction.
- M. Align wall-mounted outlet boxes for switches, thermostats and similar devices.
- N. Provide cast outlet boxes in exterior locations and wet locations.
- O. Outlet boxes for switches shall be mounted at a height of 4'-0" from the floor except as otherwise noted.
- P. Outlet boxes for receptacles shall be located 1'- 3" from the floor unless otherwise noted.
- Q. Mounting height shall be as measured from finished floor to center line of coverplate.

#### PART 3: EXECUTION

#### 3.01 DELIVERY AND STORAGE

- A. Delivery. Prepare boxes, fittings, and accessories for shipment.
- B. Storage and Handling at Job Site. The Contractor shall store and handle all boxes and fittings at the job site, while such materials are awaiting installation, in

## conformance with the following:

- 1) Store boxes, fittings, and accessories in an area protected from weather, moisture or possible damage.
- 2) Do not store material directly on the ground.

## 3.02 INSTALLATION

A. All outlet boxes shall be mounted with suitable fasteners and they shall contain the proper knockouts. On sheet metal boxes, all unused knockouts shall remain closed. Outlet or utility boxes concealed in construction shall be firmly secured in place, set true, square and flush with the finished surface for the correct application of cover plates or other devices.

**END OF SECTION** 

## SECTION 16140 WIRING DEVICES AND PLATES

#### PART 1: GENERAL

#### 1.01 SCOPE OF WORK

A. This Section of the Specifications covers wiring devices, i.e., switches, convenience outlets and special outlets; as well as device plates and special outlet boxes.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Submittals: Section 01300
- B. Electrical General Provisions: Section 16010
- C. Boxes and Fittings: Section 16130
- D. Grounding: Section 16450

#### 1.03 REFERENCE STANDARDS

- A. FSW-C-596 Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
- B. NEMA WD 1 General Purpose Wiring Devices
- C. NEMA WD 5 Specific Purpose Wiring Devices
- D. ANSI/UL 20 General Use Snap Switches
- E. ANSI/UL 498 Electrical Attachment Plugs and Receptacles
- F. National Electrical Code

#### 1.04 ACCEPTABLE MANUFACTURERS

- A. Switches
  - 1) Arrow Hart
  - 2) Hubbell
  - 3) Bryant
  - 4) General Electric
  - 5) Pass & Seymour (P&S)
  - 6) Engineer Approved Equal
- B. Receptacles
  - 1) Arrow Hart
  - 2) Hubbell

#### PART 2: PRODUCTS

#### 2.01 DEVICES

- A. Wall Switches shall be specification grade rated 20 amp, 125 volts of appropriate color (ivory unless otherwise noted). Equal to G.E. 5951-2.
- B. Convenience outlets shall be as specified on the drawings.
- C. Use twist-lock receptacles for connection of cord connected equipment. Rating to be as required by equipment. Furnish matching plug.
- D. For manual starting of single phase motors below 1/2 HP, provide manual start switches. Manual start switches to be Allen Bradley Bulletin 600 Series, Square D Class 2510 or 2512, or approved equal by General Electric or Westinghouse.

#### 2.02 DEVICE PLATE AND COVERS

- A. Cadmium or stainless steel plates shall be throughout. Plastic coverplates will not be accepted.
- B. Plate mounting screws shall be the same finish as the plates and be constructed of stainless steel or brass.
- C. Weatherproof device plates shall be lockable in the "on" or "off" position.
- D. Weatherproof outlet covers shall be spring door with hasp suitable for pad locking in the closed door position. Covers shall accommodate wiring such that weatherproof rating is maintained even with the plug inserted in the receptacle.
- E. Install permanent labels on all coverplates identifying the circuit number that the device is connected to.

#### PART 3: EXECUTION

#### 3.01 DELIVERY AND STORAGE

- A. Delivery. Prepare wiring devices and accessories for shipment in weatherproof and crush resistant packaging.
- B. Storage and Handling at Job Site. The Contractor shall store and handle all wiring devices at the job site, while such materials are awaiting installation, in conformity with the following:
  - 1) Store wiring devices and accessories in an area protected from weather, moisture or possible damage.
  - Do not store materials directly on the ground.
  - 3) Handle items to prevent damage to interior or exterior surfaces.

#### 3.02 INSTALLATION

- A. Wall switches shall be mounted 4'-0" above floor or grade unless noted otherwise.
- B. Convenience outlets indoors will be mounted 15-inches above the floor unless otherwise indicated.
- C. Install twist-lock plugs on cord connected equipment.
- D. Mount convenience outlets outdoors on galvanized channel iron supports per Section 16010. Mounting height shall be 30" above finished grade or slab level as applicable.

**END OF SECTION** 

#### PART 1: GENERAL

#### 1.01 WORK INCLUDED

The work under this Section consists of furnishing and installing all cabinets and enclosures required.

#### 1.02 REFERENCES

- A. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. ANSI/NEMA ICS 1 Industrial Control Systems.
- C. ANSI/NEMA ICS 4 Terminal Blocks for Industrial Control Equipment and Systems.
- D. ANSI/NEMA ICS 6 Enclosures for Industrial Control Equipment and Systems.

#### 1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Section 16010 and 01300 of these specifications.
- B. Include wiring schematic diagram, wiring diagram, outline drawing and construction diagram as described in ANSI/NEMA ICS 1.

#### PART 2: PRODUCTS

#### 1.02 HINGED COVER ENCLOSURES

- A. Type 12: For indoor use. Hoffman Concept Series, or approved equal.
- B. <u>Type 4X Stainless Steel</u>: Everywhere outdoors, unless noted otherwise. Also indoors where subject to extreme conditions such as splashing water, hose-directed water or wind blown rain. Hoffman Concept Series 316 SS, or approved equal.
- C. <u>Type 3R:</u> For outdoor locations, where noted. Hoffman Concept Series, or approved equal.
- D. <u>Finish</u>: Manufacturer's standard finish.
- E. <u>Covers</u>: Except where otherwise called for continuous hinge, held closed by flush latch operable by hasp and staple for padlock.
- F. <u>Back Panel for Mounting Terminal Blocks or Electrical Components</u>: 14 gauge steel, white enamel finish.

## 1.03 CABINETS

- A. <u>Cabinet Boxes</u>: Galvanized steel with removable endwalls.
- B. Cabinet Fronts: Steel, finish in gray baked enamel, unless otherwise called for.

# 1.04 TERMINAL BLOCKS AND ACCESSORIES

- A. <u>Terminal Blocks</u>: ANSI/NEMA ICS 4; UL listed.
- B. <u>Power Terminals</u>: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.
- C. <u>Signal and Control Terminals</u>: Modular construction type, channel mounted; tubular pressure screw connectors, rated 300 volts.
- D. <u>Interior Wireway and Moulding</u>: Panduit wireway size as read; conductor tie-wrapped (keep tie-wrap to a minimum); sufficient slack wiring and bound together for wiring to devices on movable panels and doors.

# 1.05 FABRICATION

- A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.
- B. Provide conduit hubs on enclosures.
- C. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

#### PART 3: EXECUTION

#### 3.01 INSTALLATION

- A. Install cabinets and enclosures plumb; anchor securely to wall and structural supports at each corner, minimum.
- B. Provide accessory feet for free-standing equipment enclosures.
- C. Furnish a nameplate for each cabinet and enclosure per Section 16010.

#### PART 1: GENERAL

#### 1.01 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish and install an electrical grounding system in conduits.

# 1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Electrical General Provisions: Section 16010

# 1.03 REFERENCE STANDARDS

- A. NEC
- B. IEEE Standard 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems.
- C. ANSI/UL 467 Safety Standard for Grounding and Bonding Equipment.

#### PART 2: PRODUCTS

#### 2.01 MATERIAL

- A. All wire and fittings shall be 98 percent conductivity copper.
- B. Ground Rods shall be Copperweld, or equal, copperclad steel rods, 3/4" X 10'-0" unless otherwise noted.
- C. Above ground connections shall be made with ground lugs, terminals, posts, etc., Burndy, Thomas & Betts, or equal.
- D. Connections below grade shall be made with Cadweld process, or equal, connections.

# PART 3: EXECUTION

#### 3.01 SYSTEM GROUNDING

A. The secondary of all alternating current distribution systems which are to be grounded shall have the common conductor connected directly to the grounding conductor at the point of supply, i.e., on the line side of the main disconnect switch.

#### 3.02 SAFETY GROUNDING OF EQUIPMENT

A. Safety grounding of equipment will be accomplished by providing an equipment ground wire, as shown on the drawings which will be no less than the size recommended in Article 250 of the National Electric Code. This ground will extend throughout the system by means of insulated green ground wires connected to ground buses in each switchgear, motor control center, panelboard and terminal on

- each outlet box, light fixture housing or grounding terminal of the motor. Install bonding jumpers from ground lugs on conduit grounding bushings to ground buses.
- B. Each ground bus in addition to connecting to its feeder ground will be grounded to the building ground rods where applicable.
- C. Connect ground wires entering outlet boxes in a manner which will allow removal of the receptacle without interrupting the continuity of the grounding circuit. A grounding screw attached to the box, and used for no other purpose, will accomplish this.
- D. Install a ground strap from all panels to a grounding screw on their respective doors.
- E. Where the equipment has no facility to attach an equipment ground wire, use a Burndy Quicklug or equal. Clean the metal surface under the lug to bright metal so that good contact can be made.
- F. Connect equipment grounds to motors using a grounding stud threaded into the stationary frame of the motor and not the end bell.
- G. Make ground connections to equipment by using ground lugs; or, ground bars where they are provided. Do not make connections to equipment anchor bolts.
- H. Connect equipment ground wires to grounding lugs in the lighting panel. DO NOT CONNECT EQUIPMENT GROUNDS AND NEUTRALS AT THE PANELBOARD.
- I. All underground cable connections and taps shall be made by a thermoweld process similar or equal to the Cadweld process. Coat connections with Koppers Bitumastic No. 505, or equal.
- J. Furnish a separate dedicated insulated ground conductor and ground rod for the instrumentation and telemetry system. Connect ground wire to a dedicated insulated ground bus in the Pump Control Panel.
- K. General items to be grounded shall consist of enclosures and/or frames for motor starters, circuit breakers, transformers, safety switches, switchgear, panelboards, motors, capacitors and exposed metal parts of similar equipment. These items shall have solidly grounded cable connections to the grounding system.
- L. Connect the X<sub>o</sub> terminal of the lighting transformer to building steel or underground metallic water piping where available. Otherwise connect to ground loop.
- M. Ground cable termination to enclosure and frames shall be similar to Thomas and Betts 71000 Series.
- N. Ground wires installed above grade to be insulated and in conduit for protection. Bare ground wires shall be installed in Schedule 40 PVC conduit.

# SECTION 16450 GROUNDING

O. In general, resistance to ground shall not exceed 5 Ohms; however, resistance to ground of the instrument ground shall not exceed 1 Ohms.

# PART 1: GENERAL

#### 1.01 SCOPE

- A. Furnish and install lighting fixtures as specified herein and indicated on the drawings.
- B. Comply with Section 16010, General Electrical Requirements.

#### 1.02 PAYMENT

A. No separate payment shall be made for labor or material under this item. All costs shall be included in the lump sum or unit prices shown in the proposal.

#### 1.03 RELATED SPECIFICATIONS

- A. 01340 Submittals
- B. 16010 General Electrical Requirements
- C. 16950 Calibration and Testing

#### 1.04 SUBMITTALS

A. Submit a lighting fixture brochure for all fixtures indicating pertinent physical characteristics, finish, pole, base, mounting, hardware, diagram of mounting, and complete photometric data.

## PART 2: PRODUCTS

# 2.01 DESCRIPTION

- A. General: Furnish fixtures in accordance with lighting fixtures, as called out on the plans.
- B. Fixtures shall bear the U.L. label. Such labels shall apply to entire fixture as installed.
- C. Accessories: Deliver all fixtures complete with suspension accessories, canopies, hickeys, casings, sockets, holders, reflectors, ballasts, diffusers, frames, recessing boxes, etc., all wired and assembled as indicated.
- D. Lamps: Furnish type and size shown on the fixture schedule. Deliver to job site in original cartons, General Electric, Sylvania, or Engineer-approved equal. All fixtures shall be furnished with 4000K LED lamps unless otherwise noted.
- E. Protection: Protect all fixtures, lenses and louvers from damage. Leave

protective coverings on lenses and louvers until fixtures are installed. Replace all damaged lenses and louvers immediately prior to final inspection at no cost to the Owner.

#### 2.02 SUBSTITUTIONS:

A. Comply with Section 16010, General Electrical Requirements.

#### PART 3: EXECUTION

#### 3.01 INSTALLATION

- A. Lighting fixture locations, as shown on the drawings, are approximate. The final location shall be dependent on physical locations encountered during construction. Where lighting fixtures conflict with work by other trades, and must be relocated, the Contractor shall have written approval from the Engineer prior to relocating the fixtures.
- B. Maintain perfect horizontal and vertical alignment of fixtures throughout.
- C. Fixtures with medium base sockets shall be wired with no smaller than #16 AWG, mogul sockets with no smaller than #14 AWG Type AF asbestos covered wire, and wire fluorescent fixtures with minimum #16 AWG Type AF wire.
- D. Do not locate splices or taps within an arm, stem or chain.
- E. Locate fixtures to avoid interference with piping, fans, ducts, and other obstructions. Obtain approval of any location differing from the location shown on the plans.
- F. Support fixtures adequately by approved means.
- G. Replace any damaged fixtures or lens at no cost to the Owner. Leave any protective covering on lens until the fixture is installed.
- H. Install all fixtures parallel to walls and structural members.
- I. Support all pendant fixtures with swivel type hangers.
- J. Install recessed luminaires to permit removal from below to gain access to the outlet or prewired fixture box.
- K. Connect recessed luminaire to boxes with flexible conduit and fixture wire.
- L. Support fixtures mounted in suspended ceiling with exposed T-bar grid system shall be supported from the ceiling T-bar grid structure and secured thereto.
- M. Support fixtures more than two feet wide by four hangers per luminaire minimum independent of ceiling structure or T-bars.

- N. Support fixtures that are surface-mounted on T-bar grid ceilings by twist clips at each end and in the center. In addition, provide on T-bar grid hanger support at each corner if the same is not provided by the ceiling installer.
- O. Area Lighting Fixture Metal Poles:
  - 1) Install steel pole on base, in accordance with pole manufacturer's requirements, using anchor bolts of a material and size specifically made for this application. Orient base parallel with curb line.
  - 2) All conduits stubbing up through the base shall be rigid galvanized steel with a plastic insulated bushing on the end.
  - 3) Install a 3/4" x 10'-0" ground rod at the base of the pole to ground the pole.
  - 4) Plumb pole first using leveling nuts then grout in space between base of pole and footing with non-shrink grout.
  - 5) Prime all metal surfaces prior to application of two coats of paint finish. Paint finish shall be suitable for a corrosive environment.
  - 6) Fixture anchor bolts, nuts, and base plate shall be prime coated after installation.
  - 7) Furnish structural concrete base for fixtures. Concrete installation shall comply with 03002.

# SECTION 16900 INSTRUMENTATION AND CONTROLS - GENERAL

#### PART 1: GENERAL

#### 1.01 SCOPE

- A. Furnish instrumentation and controls system which will perform the functions specified herein. The system is to be composed of the components described in this Section and specified in more detail in the referenced Sections.
- B. The instrument and control system shall consist of all primary elements, transmitters, switches, controllers, computers, recorders, indicators, panels, signal converters, signal boosters, amplifiers, special power supplies, special cable, shielded cable, special grounding and isolation, auxiliaries, software, wiring and other devices and components required to provide indication and alarm for the elevated storage tank as specified in the Contract Documents.
- C. Electronic control signals shall be 4-20 mA, 24 Vdc unless otherwise specified.
- All signals shall be directly linearly proportional to the measured variable unless otherwise noted.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Electrical General Information: 16010.
- B. Submittals: 01300.
- C. Wire and Cable: 16120.
- D. Grounding: 16450.
- E. Instruments: 16901
- F. Control Panels: 16902
- G. Scada System: 16904
- H. Testing Instrumentation and Controls: 16951

#### 1.03 REFERENCE STANDARDS

- A. ANSI (American National Standards Institute)
- B. AISC (American Institute of Steel Construction)
- C. ASTM (American Society for Testing and Materials)

- D. AWWA (American Waterworks Association)
- E. JIC (Joint Industrial Council)
- F. NEMA (National Electrical Manufacturers Association)
- G. NEC (National Electrical Code)
- H. ISA (Instrument Society of America)
- I. SAMA (Scientific Apparatus Manufacturers Association)

#### 1.04 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers for the various instrument and control components are listed in the following Sections of the Instrument and Controls Division of these Specifications.

#### 1.05 SPECIAL CONDITIONS

- A. All components to be used in the instrument and control systems are to be new (not used) and the current model produced by the manufacturer.
- B. All equipment of a common type is to be the product of a single manufacturer.

# 1.06 SYSTEM COORDINATION

- A. Design instrument system and subsystems in accordance with Plans and Technical Specifications and all applicable codes and standards.
- B. Coordinate installation of instrumentation with mechanical and electrical systems.
- C. Plans and Technical Specifications do not necessarily show or specify all components, wiring, piping and accessories required for a complete and workable system. Contractor shall be responsible for all materials, supplies, labor and supervision to ensure a completely integrated and coordinated instrumentation system.
- D. Coordinate subsystems to provide a complete operational and functional instrumentation system.

# 1.07 ENVIRONMENTAL CONDITIONS

- A. Temperature: 0° to 120° F.
- B. Relative Humidity: 98 percent maximum.
- C. Process Fluid Temperature: 32° to 150° F.

# 1.08 SOURCE QUALITY CONTROL

- A. Factory test each instrument over its full operating range where applicable.
- B. Shop assemble each panel and test before delivery to jobsite.

# 1.09 SUBMITTALS

- A. <u>General</u>: Do not design, manufacture, or ship any equipment until the Engineer has reviewed all related submittals. Submit shop drawings and product data in complete functional packages; i.e., submit all shop drawings and product data for a given loop or subsystem together as a functional package. Piecemeal submittals not organized by systems or incomplete submittals for a given loop or subsystem will not be accepted.
- B. Comply with Sections 01300 and 16010.
- C. <u>Shop Drawings</u>: Submit shop drawings in accordance with the following:
- D. Prior to the first shop drawing submittal, provide certification that the design has been completed and all interrelationships of the specific instruments proposed taken into account; and that the design accomplishes the functions described herein and shown on the Plans.
- E. <u>Loop Diagrams</u>: Prepare loop diagrams per ISA Standard S5. Include the following information:
  - 1) Functional name of loop.
  - 2) ISA tag numbers (use the same numbering system as shown on the Contract Drawings).
  - 3) Functional name and manufacturer's model, product or catalog number for each item in the loop.
  - 4) Location of each item.
  - 5) Functional description.
  - 6) Reference drawings.

# F. Field Wiring and Piping Diagrams:

- 1) Color coding.
- 2) Wiring and piping sizes and types.
- 3) Designation of conduits in which wiring is to be run.
- 4) Panel terminal strip numbers.

- 5) Location, functional name and manufacturer's designation of items to which wiring and piping are connected.
- 6) Operation description with control set points.
- G. Submit the following product data for each item of equipment or material:
  - 1) Manufacturer's product name and number.
  - 2) Tag number, if applicable.
  - 3) Functional name.
  - 4) Description of construction and features.
  - 5) Performance data.
  - 6) Service requirements, e.g., power, water, etc.
  - 7) Dimensions.
  - 8) Calibration data and curves for instruments and other items which require factory calibration.
  - 9) Installation instructions.
- H. Submit four copies of the following reports:
  - 1) Factory calibration reports.
  - 2) Installation inspection reports.
  - 3) Field calibration reports.
  - 4) Field system test report.
- I. <u>Guarantee:</u> Submit a copy of the proposed manufacturer's guarantee and information about the nature and location of parts, service crews and repair facilities.

# 1.10 OPERATION AND MAINTENANCE MANUALS

- A. Furnish Operation and Maintenance Manuals complying with Section 16010 and including the following contents:
  - 1) Information as specified in Paragraph 1.9 with the following modifications to the shop drawing exhibits:
  - 2) Reflect "As-Built" conditions.
  - 3) Prints of exhibits to be half size.

- 4) Prints to be placed in clear sealable plastic envelopes which are suitable for binding in a 3-ring loose-leaf binder.
- 5) Operating procedures.
- Shut-down procedures.
- 7) Safety instructions.
- 8) Calibration instructions and factory test results of each instrument.
- 9) Maintenance and repair instructions.
- 10) Recommended spare parts list.
- 11) Name, address and phone number of instrumentation/control system supplier's local representative.

#### 1.11 WARRANTY

A. The Contractor shall guarantee the entire system to operate in the manner prescribed herein for a period of one year from the date of final acceptance.

#### PART 2: PRODUCTS

#### 2.01 GENERAL

A. See Sections referenced in 1.2 above for specifications of individual instruments.

## PART 3: EXECUTION

# 3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. <u>Delivery</u>: Deliver materials and equipment to jobsite with sufficient protection to ensure arrival in an undamaged condition.
- B. <u>Storage</u>: All materials and equipment to be stored above the floor of a trailer or other weather-protected structure.
- C. <u>Handling</u>: Handle so as not to sustain damage of any kind to equipment during unloading, storage or installation.

#### 3.02 INSTALLATION

- A. <u>General</u>: Install all equipment in accordance with the Plans and instructions furnished by the manufacturer. Inspect each new instrument, control component, etc., before installation. Replace deficient items.
- B. <u>Installation Report</u>: After installation, the manufacturer's representatives are to

inspect the installation and prepare a report or reports to include the following:

- 1. A list of all deficiencies found.
- Recommended corrective action for all facilities.
- 3. Certification that the item or system is properly installed except as noted.
- C. Install instrument mounting pipe stands level and plumb. Mounting stands shall be as shown on the drawings.

# D. Instrument Valves:

- 1) Orient stems for proper operation.
- 2) Install arrays orderly and neat in appearance with true horizontal and vertical lines.
- 3) Provide a minimum of 2 inch clearance between valve handle turning radii where there are multiple valve handles appearing in a straight line.
- 4) Valves shall have bonnets and any soft seals removed during welding or soldering into the line. When cool, reassemble the valves.
- 5) Support each valve individually. The tubing system does not qualify as support for the valve.
- 6) Locate instrument piping and tubing so as to be free of vibration and interference with other piping, conduit or equipment.
- 7) Keep foreign matter out of the system.
- 8) Remove all oil on piping and tubing with solvent before piping and tubing installation.
- 9) Plug all open ends and connections to keep out contaminants.

# E. Tubing Installation (General):

- 1) Install such that tube shows no sign of crumpling, bends of too short a radius, or flattening, etc.
- 2) Make tube runs straight and parallel or perpendicular to the floor, equipment and piping runs.
- 3) For liquid and steam applications, slope continuously from the process to the instrument with a minimum slope of 0.50 IN per foot.
- 4) For gas and air applications, slope continuously from the instrument to the process with a minimum slope of 0.50 IN per foot.

- 5) If the sensing line cannot be continuously sloped, install high point vents and low point drains.
- 6) Keep instrument tubing clean during all phases of work.
- 7) Blow out with clean, dry, oil-free air immediately before final assembly.

# F. Stainless steel tubing:

- 1) Cut by sawing only and debur.
- 2) Make each bend with tube bender of the correct size for the tube.
- 3) Make all bends smooth and continuous.
- Rebending is not permitted.
- 5) Make bends true to angle and radius.
- 6) Maintain a true circular cross section of tubing without buckling or undue stretch of tube wall.
- 7) Allowable tolerance for flattening out of tubing bends: Maximum of 8 percent of the OD for stainless steel tubing.
- G. Minimum bending radius:

# TUBE OD INCHES MINIMUM BENDING RADIUS, INCHES

1/2 1-1/2

# H. Tubing support:

- 1) Intermittently support by clamping to support angle.
- 2) Install supports to be self-draining, supported by hangers or cantilevered from walls or structural beams.
- 3) Support at 5 FT 0 IN maximum spans for horizontal or vertical runs.
- 4) Use tubing trays in areas where spans between supports are greater than 5 FT and for all signal tubing support.
- 5) Support each tubing tray at 10 FT maximum spans.
- 6) Align tubing in orderly rows and retain in the tray by bolted clips. The use of spring or speed clips is not acceptable.
- 7) Maintain order of the tubing throughout the length of the tray.

- 8) Locate angle, channel and tray installation to protect tubing from spills and mechanical damage.
- 9) Locate support members to clear all piping, conduit, equipment, hatchways, monorails and personnel access ways and allow access for equipment operation and maintenance.
- 10) Support trays to prevent torsion, sway or sag.
- 11) Permanently attach supports to building steel or other permanent structural members.
- 12) Arrange supports and trays so that they do not become a trough or trap.

# I. <u>Instrument Mounting</u>:

- 1) Mount all instruments where they will be accessible from fixed ladders, platforms or grade.
- 2) Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.
- 3) Mount instruments level, plumb and support rigidly.
- 4) Mount to provide:
  - a) Protection from heat, shock and vibrations.
  - b) Accessibility for maintenance.
  - c) Freedom from interference with piping, conduit and equipment.
- 5) Do not mount current-to-pressure transducers on the control valves unless the transducers are received from the Manufacturer already valve mounted and tubed or specific instructions to valve mount the transducers are given on the Drawings.
- J. Connect surge arresters to ground.

# 3.03 FIELD QUALITY CONTROL

- A. Maintain accurate daily log of all startup activities, calibration functions and final setpoint adjustments.
- B. In the event that instrument air is not available during calibration and testing, supply either filtered, dry, instrument quality air from a portable compressor or bottled, dry, instrument quality air. Do not, under any circumstances, apply hydrostatic test to any part of the air supply system or pneumatic control system.
- C. Comply with Section 16951: Testing Instruments and Controls.
- D. Provide verification of system assembly, power, ground and I/O tests.

- E. Verify existence and measure adequacy of all grounds required for instrumentation and controls.
- F. During the demonstration period, observe each signal circuit for the existence of electrical noise. Utilize noise suppression techniques given in Section 6.5, "Suppressive Techniques," of IEEE 518 for all circuits for which electrical noise introduces an error greater than the instrumentation accuracy.

#### PART 1: GENERAL

#### 1.01 GENERAL NOTE

A. This Section of the Specifications describes the instruments to be furnished on this Project.

## 1.02 SCOPE OF WORK

A. Furnish each instrument complete with all accessories and appurtenances specified herein or as otherwise required for a satisfactorily operating instrument.

#### 1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Submittals: Section 01300
- B. Electrical General Information: Section 16010.
- C. Instrumentation and Controls-General: Section 16900

# 1.04 REFERENCE STANDARDS

- A. ANSI (American National Standards Institute)
- B. AISC (American Institute of Steel Construction)
- C. ASTM (American Society for Testing and Materials)
- D. AWWA (American Waterworks Association)
- E. JIC (Joint Industrial Council)
- F. NEMA (National Electrical Manufacturers Association)
- G. NEC (National Electrical Code)
- H. ISA (Instrument Society of America)
- I. SAMA (Scientific Apparatus Manufacturers Association)

# 1.05 MAINTENANCE

- A. Provide spare parts recommended by the manufacturer.
- B. Provide any special tools, which may be required for installation.

# 1.06 QUALITY ASSURANCE

- A. All instruments of a like type shall be the product of the same manufacturer. Acceptable manufacturers shall be as indicated herein.
- B. All materials used shall be new and of the best quality. Substandard material or used/remanufactured materials will not be accepted.
- C. Instruments shall be of domestic manufacture using parts made in the U.S.A; and they shall be assembled and tested in the U.S.A.
- D. All equipment shall be of the latest and most modern design and shall have the overall accuracy as guaranteed by the manufacturer or as specified herein. One manufacturer shall furnish all components.
- E. All instruments shall be factory-tested and calibrated.

#### 1.07 MANUFACTURER'S SERVICES

- A. Provide the services of factory-trained technical representatives of the various components to assist in start-up. At a minimum, the following services are to be provided:
  - 1) Inspect the complete installation to assure that it is installed with manufacturers recommendations.
  - 2) Make adjustments necessary to place the system in trouble-free operation.
  - 3) Instruct operating personnel in the proper care and operation of the equipment.
  - 4) Provide required assistance during start-up of the applicable system.

#### 1.08 SUBMITTALS

A. Submittals shall comply with Section 16900

#### 1.09 WARRANTY

A. Manufacturer shall guarantee against faulty or inadequate design, improper assembly or fabrication and defective workmanship or materials for a period of twelve months from the data of final acceptance of the installation. Manufacturer shall guarantee to correct any and all deficiencies at no cost to the Owner as long as the Warranty is in effect. Cost of shipment shall be included in the Warranty.

#### PART 2: PRODUCTS

# 2.01 LEVEL RANSMITTER

A. Level transmitter shall be Foxboro IA Series, or approved equal. The transmitter

is to convert the pressure applied to the diaphragm pressure seals, to a 4-20 mA DC electrical output that is linear with the ground storage tank level.

- B. The transmitter is to be the intelligent type with remote communications for measuring level, and transmitting a 4 to 20 mA DC output signal that is proportional to the discharge pressure. Transmitter is to be furnished with a remote handheld communicator (programmer/terminal) that can be connected at any point in the loop (4-20 mA output signal).
- C. The transmitter is to have the following features:
  - 1. Two-wire 4-20 mA DC or digital output (software selectable) proportional to level.
  - 2. 0.10% accuracy of calibrated span.
  - 3. Zero elevation/suppression to range limits.
  - 4. Electrical Classification: Intrinsically safe to FM, CSA, BASEEFA, SAA and CENELEC standards.
  - 5. Deadband of less than plus or minus 0.01% of range.
  - 6. Transmitter is to withstand a transient surge of 2,500 volts (in accordance with ANSI/IEEE Standard C37.90.1-1989) without damage or calibration shift.
  - 7. The transmitter is to withstand overrange up to 1.5 times the upper-range limit, with negligible change in output upon removal of overrange/underrange.
  - 8. Transmitter output error to be less than 0.1% of calibrated span when subjected to radio frequencies in the range of 27 to 1,000 MHZ and field intensity of 30 v/m.
  - 9. The transmitter total error at a reference calibrated range of 0 to 100 psi which includes accuracy and ambient temperature shall not exceed 0.41% (RMS).
  - 10. Process Connections: 1/2-inch NPT female.
  - 11. Capillary tube length to be as required for installation by the drawings. However, minimum length to be 6 feet for remote mounting.
- D. The transmitter shall meet the specified performance under the following temperature, voltage and output load operating conditions:
  - 1. Ambient Temperature Limits: -40 degrees  $\Box$ F to +185 degrees  $\Box$ F.
  - 2. Process Temperature Limits: -50 degrees  $\Box$ F to +250 degrees  $\Box$ F.
  - 3. DC Loop Supply Voltage: 12 to 42 VDC.
  - 4. Output Load: 200 to 1,450 ohms.

- E. The transmitter is to be equipped with local indicator (integral to transmitter) which is calibrated in units of pressure and to the range of the transmitter. The indicator is to be of the digital type with liquid crystal display (LCD), driven by the loop power (4-20 mA at 24 VDC), and have an accuracy within 0.2% of full scale.
- F. The transmitter diaphragms are to be 316 stainless steel and the space between the diaphragms is to be filled with silicon oil.
- G. The transmitter is to be equipped with a mounting device for 2" PVC coated pipe stand.
- H. Construction of transmitter to be as follows:
  - 1. Body: Cadmium-plated carbon steel.
  - 2. NEMA-4X watertight and corrosion resistant enclosure.
  - 3. All wetted parts, including the diaphragm which protects the sensor, are to be AISI Type 316 stainless steel (316SS).
  - 4. The non-process wetted transmitter housing shall be coated with a durable and chip resistant epoxy coating/finish.
  - 5. Furnish complete with indicator and mounting brackets as specified above.

## 2.02 LEVEL SWITCHES

- A. Level switches shall be B/W controls with 24 volt electrode for vertical mounting.
- B. Probes shall be solid rod type, 316 SS with threaded end for fit up to the electrode holder. The electrode holder shall be 316 SS with NPT threads for mounting to an attachment on the tank.
- C. Probes shall be connected to solid state relays in the RTU. Relays shall be B/W Controls 5200 Series, or approved equal, with 10 amp, 120 VAC contacts.

# 2.03 DOOR SWITCHES

- A. Door switches shall be inductive proximity type, Square D #XS1M18MA239 with XSZB118 mounting bracket, or approved equal.
- B. A splice box shall be installed near the switch to enable splicing of the switch leads with the wiring from the control panel.
- C. Operator shall be able to reset the alarm upon entering the Elevated Storage Tank door by entering a code on the OID.

# PART 3: EXECUTION

# 3.01 SHIPPING, STORAGE AND HANDLING

- A. Shipping: Instruments are to be crated and shipped in crush-proof containers. Manufacturer shall bear responsibility for any damages incurred in shipment.
- B. Storage: Store transmitter in a humidity-controlled area protected from weather and possible damage. Do not store in direct contact with the ground.
- C. Handling: Handle transmitter carefully to prevent damage to internal electronics, diaphragms, strain gauges, etc.

#### 3.02 INSTALLATION

A. General: Install instruments in accordance with the manufacturer's recommendations. Include all necessary piping, tubing, isolation valves, fittings, etc.

## 3.03 FIELD CALIBRATION AND TESTING

- A. Instrumentation Calibration: Calibrate instruments and prepare calibration reports.

  All calibration to be performed by a factory-trained technical representative.
- B. System Testing: Each system to be tested by an experienced factory-trained technical representative. Perform the following tests using simulated inputs:
- C. Check the overall system to see that it functions as specified based on simulated inputs at each sensor and at each set of field contacts monitored. This check to include the testing of all automatic functions, sounding of alarms, etc.
- D. Check the overall accuracy of each instrument loop to ensure that it is within acceptable tolerance.
- E. Comply with the manufacturer's recommendations.
- F. Defects: If defects are found under simulated conditions, make corrections and retest.
- G. Start-up Testing: After start-up, test the complete system under actual conditions to determine that all specified functions can be performed.
- H. System Test Report: After completion of testing, submit a System Test Report to include the following:
  - 1) Certification that the system is operating correctly and within tolerances.
  - 2) Listing of calculated tolerances for each new and modified instrument loop.

# SECTION 16902 CONTROL PANELS

# PART 1: GENERAL

# 1.01 SCOPE OF WORK

- A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish and install the instrument/control panel.
- B. Comply with the requirements of Section 16900

## 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Electrical General Information: Section 16010.
- B. Wire and Cable: Section 16120.
- C. Grounding: Section 16450.
- D. Instrumentation and Controls General: Section 16900.
- E. Instruments: Section 16901.

# 1.03 REFERENCE STANDARDS

- A. NEMA
- B. UL 508
- C. NEC
- D. ISA
- E. JIC EGP-1

# 1.04 SUBMITTALS

- A. Make all submittals in conformance with Section 16900.
- B. Include the following:
  - 1) Scale drawings showing the location of face-of-panel mounted devices. Include a legend listing and identifying the face-of-panel devices by their assigned tag numbers, nameplate inscriptions, service legends and annunciator inscriptions.
  - 2) A listing of devices mounted within the panel. Include the tag number, description, manufacturer and complete model number for each device.

- 3) Panel elementary diagrams similar to and developed from the drawings. Add switched analog signals, panel power distribution, and ancillary devices such as relays, alarms, fuses, lights, fans, heaters, etc. Show circuits and components individually. Show panel terminal and wire identification numbers. Do not submit typical diagrams for multiple circuits.
- 4) Plumbing diagrams of preplumbed panels and interconnecting plumbing diagrams.
- 5) Color schedule with color samples and paint chips for the control panels and consoles.
- 6) Power requirement and heat dissipation summary for all panels. State required voltages, currents, and phase(s). State maximum heat dissipation in Btu/hr.
- 7) Air conditioner sizing calculations.
- 8) Data sheets, which contain specific features such as ranges and options.
- 9) A device list, grouped by device type, for each panel. Include the complete manufacturer's part number, including option designations.
- 10) Cut sheets and catalog information for pre-manufactured enclosures. Indicate options to be supplied.
- 11) Fabrication drawings for custom enclosures.
- 12) Certified factory test reports.

# 1.05 MAINTENANCE

- A. Provide the following spare parts:
  - 1) One relay for every 10 relays or fraction thereof. Furnish a minimum of one spare for each type of relay.
  - 2) Other replacement parts as recommended by the manufacturer.
- B. Provide the following special tools:
  - 1) Lamp puller and installer.
  - 2) Mounting ring wrench(s) for pushbuttons switches and lights.
  - 3) Relay checkout tool to hold relay in operated position.
- C. Provide the following expendables:

- 1) One light bulb for every 10 light bulbs or fraction thereof for each type of bulb supplied.
- 2) One spare fuse for each 5 fuses of any type installed. Furnish a minimum of one fuse of each type.

# 1.06 OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance Manuals in accordance with Section 16900

#### PART 2: PRODUCTS

# 2.01 GENERAL

- A. The panel shall contain the items shown on the schematic diagrams including the following:
  - 1) Circuit breakers.
  - 2) Control relays.
  - 3) Surge protection.
  - 4) PLC
  - 5) Control terminal blocks.
  - 6) PLC terminal blocks.
  - 7) Fuse terminal blocks.
  - 8) Wireway.
  - 9) Cabinet light and switch.
  - 10) Cabinet receptacle.
  - 11) Wiring and miscellaneous.
  - 12) Power Supplies
  - 13) Radio
  - 14) Analog input Isolators
  - 15) Ethernet switch
  - 16) Alarm relay
  - 17) I/O relays.

# 2.02 ENCLOSURES

- A. Panels are to be constructed to the approximate dimensions and instrument arrangement as shown on the Plans. Submit alternate arrangements and recommendations to the Engineer for review.
- B. All instruments, devices and wiring are to be arranged such that everything can be installed, removed and serviced through the door.
- C. Wire entering the panels is to enter via conduits with bushings. All wiring is to be terminated on terminals located on an interior panel prior to being connected to any instrument or switch.
- D. The interior of each panel is to be painted white and the exterior color is to be selected by the OWNER from paint samples furnished by the manufacturer.

- E. Each panel is to be equipped with a print pocket for storing applicable drawings.
- F. Panel doors are to have heavy gauge continuous hinges. Hinges and doors are to be capable of supporting weight of equipment mounted on doors.
- G. Mounting channels, swing panels and interior panels are to be provided in the cabinets for mounting pushbuttons, indicating lights, meters, instruments, terminals, relays, etc.
- H. The panel is to be completely assembled and wired at the factory such that installation can be accomplished by connecting field wiring to terminal strips located on a lower portion of the interior panel.
- I. Panels located indoors shall be NEMA 12 conforming to UL 508, JIC Standard EGP-1-1967. Panels located outdoors shall be NEMA 4X, 316 stainless steel.
- J. Panels are to be constructed from minimum 14-gauge steel. Seams are to be continuously welded with no holes or knockouts. Doors are to have rolled lip around three sides and are to be equipped with a hasp and staple for padlocking. Doors on outdoor enclosures are to have stainless steel clamps to provide a watertight seal. All doors are to have an oil resistant gasket.
- K. A full size steel back panel is to be provided inside each enclosure. Relays, terminal blocks, etc., are to be mounted on the back panel. Enclosures located indoors are to be Hoffman Proline Series, or equal. Outdoor enclosures are to be Hoffman Type WS series, or equal, with sloped top.
- L. Cut, punch or drill cutouts for face-of-panel mounted instruments and smoothly finish with rounded edges.
- M. Provide steel stiffeners on the back of the panel face as may be required to prevent deflection due to instruments, operation of equipment, or opening/closing of doors. Use 0.25 inch high by 1 inch wide by 0.5-inch deep minimum stiffeners and tack welded to the panel.
- N. Provide internal condensation and freezing protection with thermostatically controlled heater on outdoor enclosures. Thermostat adjustable between  $40^{\circ}$  F to  $80^{\circ}$  F.
- O. Provide a print pocket within enclosures.
- P. Each panel is to contain a weatherproof duplex receptacle (1P, 20A, 120V, 3W polarized), ground fault interrupter (GFIR) type.
- Q. Provide all cabinets over 18" wide with a LED light. Provide complete with limit switch to activate light when door is opened. Light is to be Hoffman or approved equal

R. Furnish outdoor enclosures with thermostatically controlled vent fan and filtered louvers where specified on the drawings.

#### 2.03 CONTROL COMPONENTS

- A. Pushbuttons, selector switches and pilot lights are to be heavy-duty oil tight industrial type as manufactured by Square D, Allen Bradley, General Electric or Westinghouse. NEMA 4 pushbuttons, selector switches and pilot lights are to be provided for outdoor panels. Pilot lights shall be LED type, push to test.
- B. <u>Legend Plates</u>: Manufacturer's standard with lettering indicated on the Plans. To be of the same manufacture as the respective pushbutton, selector switch or pilot light.
- C. <u>Control Relays</u>: Square D, or equal, 11 pin octal base relay with on/off pilot light, 120 VAC, 60 Hz coil, 10 amp, 3 PDT contacts. With screw terminal socket.
- D. <u>Timing Relays</u>: Square D JCK70, or equal. On or off delay as required. 120 VAC, 60 Hz coil, 10 amp, DPDT contacts. Timing range of .05 secs. to 999 minutes. Plug in tube base type.
- E. <u>Circuit Breakers</u>: Circuit breakers shall be molded case type with thermal magnetic trip. Breakers shall be Square D Type QO, or approved equal. Mounting brackets shall be provided to mount breakers on the back panel.
- F. <u>PLC:</u> MicroLogix 1400 1766-L32AWA, or approved equal. PLC with 20 discrete inputs discrete, 12 discrete outputs and with a separate 4 Pt. 1762-IF4 analog input module. With 1766-MM1 memory module.
- G. <u>SURGE SUPPRESSOR:</u> 120 VAC, , 5 AMP, active tracking filter, 45 KA, 10 yr warranty. Sola STFV030-10N.
- H. <u>UPS:</u> APC 350 VA, 210 Watt, 8 outlets (3 surge protected). APC BK350 CDW P/N 290573.
- I. <u>POWER SUPPLY:</u> Allen Bradley 1606-XL-850B, 24V, 3.4 A, Current limiting with short circuit and overload protection built in.
- J. <u>SIGNAL SPLITTER:</u> Acromag 653T-0600 with 4-20 mAdc input and 2 4-20 mAdc outputs.
- K. <u>ELECTRODE RELAY:</u> BW Controls 1500-F-L-1-S7-OC-X. With 2 N.O., 1N.O. holding contact. 25 A rated contacts.
- L. <u>RADIO:</u> Radio shall be relocated from the existing control panel in the pump building.
- M. <u>ETHERNET SWITCH:</u> NTRON 4TX. 4 Port.

# 2.04 WIRING

- A. <u>General Wiring</u>: Use #16 AWG, 19 strand copper with Type MTW insulation.
- B. <u>Flexible Wiring</u>: Use #16 AWG, 41 strand copper Type SIS for wiring from terminal blocks to 120 VAC devices located on cabinet doors, i.e., pushbuttons, selector switches, pilot lights and annunciator. Leave sufficient slack to allow for full opening of cabinet door.
- C. <u>Instrument Wiring</u>: Twisted pair, #18 AWG, stranded copper. Dekoron No. 1852, or equal. Ground shield only at terminal board. Leave sufficient slack for full opening of door.
- D. Segregate dc signal wiring from ac control wiring, group functionally and arrange neatly to facilitate tracing of circuits.
- E. Use Panduit, or equal, wiring ducts where possible, and provide a minimum of 20 percent spare space. Run ac and dc in separate ducts.
- F. Use plastic wiring wraps to bundle wires outside of ducts. Secure to panel steel at maximum 12-inch intervals. Bundle ac and dc separately.
- G. Provide Brady, or equal, wire markers to identify each wire at both the terminal block and the device, i.e., at both ends.

#### H. Color code as follows:

- 1) Line and load circuits ac or dc power Black
- 2) AC control circuits Red
- 3) DC control circuits Blue
- 4) Interlock control circuits on the panel energized from an external source Yellow
- 5) Equipment grounding conductors Green
- 6) Neutral conductor White

# I. Terminal Blocks:

- 1) Factory assembled on a Din rail or suitable mounting channel.
- Provide a minimum of 25 percent spare terminals on each strip. In addition, provide terminal blocks for terminating spare wires being installed on this project.
- 3) Continuous marking strip.
- 4) Separate terminal for each shield wire.
- 5) Reserve one side of each strip for incoming field wiring. Do not make common connections and jumpers required for internal wiring on the field side of the terminal.
- 6) Do not terminate more than two wires under any one terminal.
- 7) Provide separate terminal blocks for ac and dc wiring respectively.
- 8) Space terminal block strips no closer than 4 inches center to center.
- 9) Control terminal blocks shall be Phoenix Contact Type UK5, or approved equal.

- 10) Fused terminal blocks shall be Phoenix Contact Type UK6, 3-HESI, or approved equal.
- 11) Power terminal blocks shall be Square D Class 9080, Type K, or approved equal.
- 12) Power fuse blocks shall be Square D Class 9080, Type FB, or approved equal.
- 13) Power distribution blocks shall be Square D Class 9080, Type LB, or approved equal.

## J. Grounding:

- 1) Provide one ground bus for signal grounds and one for equipment grounds.
- 2) Provide each bus with grounding lugs for connection to the external grounding system.
- 3) Overload: 15% for 2 minutes.
- 4) Waveform: Step sine wave with count peak and RMS.
- 5) Frequency: 60 Hz., +/-0.6 Hz.

#### 2.05 INSTRUMENT AND CONTROL PANEL IDENTIFICATION

A. All devices on the panel are to be permanently identified. The device designations are to agree with those shown on the drawings. Each device is to be provided with permanent type identifying nameplate. Nameplates, unless specified otherwise, are to be approximately one inch by four inches, constructed of black and white laminated phenolic material having engraved letters approximately 1/4 inch high extending through the black face into the white layer. Nameplates, where specified, may be omitted if nameplate description of approximately the same dimension is more convenient and suitable located on the instrument door or face. Nameplates located on the panel face are to be secured with two brass screws. Nameplates, which are mounted on the outside of an enclosure, exposed to weather, are to be adhesive backed type.

# 2.06 OPERATION AND MAINTENANCE MANUALS

- A. Provide six (6) hard copies and two electronic copies (on hard drives) of operation and maintenance manuals containing the following information:
  - 1) Wiring diagrams.
  - 2) Panel face layout to scale.
  - 3) Interior layout to scale.
  - 4) Operation and maintenance instructions on the instruments supplied with the panel.

#### PART 3: EXECUTION

#### 3.01 SHIPMENT AND STORAGE

A. Cabinets are to be prepared for shipment in weatherproof and crush-proof containers.

- B. Handling of cabinets is to be accomplished with extreme care, especially after removal from shipping containers.
- C. Cabinets to be stored in covered storage protected from the weather, dust and possible damage when handling other equipment.

# 3.02 TESTING

A. Cabinet wiring shall be factory tested prior to shipment to the site. A test certification shall be furnished with the cabinet and as part of the submittal data.

# 3.03 INSTALLATION

- A. Cabinets are to be installed in the locations shown on the Plans.
- B. All wiring is to be connected as shown on Plans and all systems are to be thoroughly checked out.

#### PART 1: PART 1 GENERAL

#### 1.01 SCOPE OF WORK

A. Provide all equipment and labor required for calibration, setting and testing as described herein or otherwise required. All tests are to be witnessed by the Owner and Engineer. Give written notification of the tests at least seven days prior. Repair or replace all defective material, equipment or workmanship disclosed as a result of these tests at no additional cost to the Owner.

# 1.02 RECORDS

A. Provide the Owner six (6) copies of reports of all of the following tests including the piece of equipment or wiring tested, the date tested, weather conditions, and test value results. Include test reports in Operations and Maintenance Manuals where applicable. Report forms shall be the same or similar to those attached to this specification.

#### PART 2: PRODUCTS

#### 2.01 MATERIALS

- A. Use meters, meggers and other test devices specifically approved for the test.
- B. Test devices to be provided with calibration certificate.

# PART 3: EXECUTION

#### 3.01 MEGGER TESTS

- A. Use a minimum 500 volt megohmmeter.
- B. Take each reading for at least one minute.
- C. Include the following tests:
  - 1) 115 and 230 volt motors..... 5.0 Megohms
  - 2) 2. 460 volt motors...... 7.0 "
  - 3) 3. 600 volt wiring up to 1000 ft....... 25.0
- D. Test all wiring including main service feeders, motor feeders and branch circuit wiring.

# 3.02 GROUND TESTING

- A. Take ground resistance measurements in normally dry weather, not less than 48 hours after rainfall, with the ground under test isolated from other grounds.
- B. Measure the resistance of each ground rod. Submit in writing to the Owner a record indicating the rod location, the resistance measured and the soil condition at the time.

- C. Take ground resistance measurements on the building water service where it is used as a ground also.
- D. Install additional grounding if the resistance to ground measures more than 25 OHM's at any location.

#### 3.03 RECEPTACLES

A. Test all receptacles for proper connections and grounding. Use an approved plug in tester.

#### 3.04 CONTROL CIRCUITS

- A. Check all circuits for continuity, proper connection and proper operations.
- B. Set all time delay relays and timers for the desired operation. Record the settings, indicating the relay or timer, its location and the setting used. Verify all settings with a stopwatch.

#### 3.05 LIGHTING

- A. Turn on all lights after lamping them with new lamps.
- B. Turn on all lights at each panelboard with lights on and submit typewritten results to the Owner. Results to include panelboard number and location, branch circuit number and load served, and amperage reading.
- C. Allow outdoor lights to remain on for 72 hours to check ballasts as well as lamps. Replace any defective material.

#### 3.06 CONTROLS AND INSTRUMENTATION

- A. Test controls and instrumentation for continuity and proper operation. Comply with Section 16951.
- B. Calibrate, set and test instruments in accordance with the Instrument Supplier's published recommendations.
- C. Provide written records of all tests. Include certifications and settings for all instruments.

# SECTION 16951 TESTING INSTRUMENTATION AND CONTROLS

# PART 1: GENERAL

#### 1.01 SUMMARY

This Section describes field testing requirements including the manner in which the testing is to take place. Refer to other applicable Sections of this Specification for testing and calibration requirements of individual instrument and control devices.

#### 1.02 SUBMITTALS

- A. The following information shall be included in the submittal for this Section:
  - 1) Loop checkout schedule.
  - 2) Loop checkout procedures including sign-off forms.
  - 3) Schedules, procedures and sign-off forms for all other tests specified.
- B. Within two weeks following completion of any field tests, test report/documentation shall be submitted to the ENGINEER.

# 1.03 GENERAL

- A. Extensive field testing shall be performed to verify the operation of the entire system.
- B. Field testing shall be sequential in nature and shall be organized by site.
- C. Site testing shall include loop checkout.

# PART 2: PRODUCTS

(Not Used)

#### PART 3: EXECUTION

# 3.01 SITE TESTING

- A. Loops
  - 1) Loop tests shall include the following:
    - a) Elevated Storage Tank Level
    - b) EST high level alarm.

- Each loop shall be tested from the element, i.e., switch, transmitter or relay, to the starter or control panel as applicable. The OWNER and ENGINEER shall witness all tests.
- 3) All loop checks shall be documented and submitted to the ENGINEER. Documentation shall include:
  - a) Loop name.
  - b) Loop description.
  - c) Termination information.
  - d) Drawing reference.
  - e) Type of test(s) performed.
  - f) Date tested.
  - g) Signature of tester and date.
  - h) Signature of OWNER and ENGINEER and date.
  - i) Problem description, if any.
- 4) 4. All loops found to contain defective or inoperable equipment shall be summarized on separate sheets and submitted to the ENGINEER and OWNER.
  - a) Work performed under this Contract shall be corrected and rechecked.
  - b) Correction of defective work by others shall be coordinated by the OWNER. Rechecking shall be performed as a part of this Contract.

# 3.02 MAINTENANCE OF OPERATIONS

- A. Field testing shall be scheduled through the Owner at least 7 days in advance.
- B. No testing that may affect operation shall be permitted without Owner's concurrence.
- C. No testing shall be performed on Monday or Friday.

# 3.03 TESTING PRECEDENTS

- A. The following conditions shall be met prior to the start of any testing:
  - 1) All documentation pertinent to the equipment being tested shall be on-site.
  - 2) All spare parts, expendables and test equipment pertinent to the equipment being tested shall be on-site, labeled and properly stored.
  - 3) All field equipment supplied and pertinent to the equipment being tested shall be operational.

- 4) Test schedules and test procedures shall have been submitted to and approved by the Owner.
- B. All test procedures and test results shall reflect information contained within the various operation and maintenance manuals furnished.

# 3.04 OWNER PARTICIPATION

- A. The Owner may participate in testing activities at its discretion.
- B. Owner's participation and use shall be such that it does not adversely affect specified testing requirements. No claim for delay shall be allowed unless the following conditions are met:
  - 1) The Owner and the ENGINEER are notified verbally that Owner actions could cause delay if continued.
  - 2) The Owner or the ENGINEER persists in the delay action.
  - 3) Written documentation is submitted to the ENGINEER within 24 hours that describes the Owner's action and impact.

### SECTION 16951 TESTING INSTRUMENTATION AND CONTROLS

### PART 1: GENERAL

### 1.01 SUMMARY

This Section describes field testing requirements including the manner in which the testing is to take place. Refer to other applicable Sections of this Specification for testing and calibration requirements of individual instrument and control devices.

### 1.02 SUBMITTALS

- A. The following information shall be included in the submittal for this Section:
  - 1) Loop checkout schedule.
  - 2) Loop checkout procedures including sign-off forms.
  - 3) Schedules, procedures and sign-off forms for all other tests specified.
- B. Within two weeks following completion of any field tests, test report/documentation shall be submitted to the ENGINEER.

### 1.03 GENERAL

- A. Extensive field testing shall be performed to verify the operation of the entire system.
- B. Field testing shall be sequential in nature and shall be organized by site.
- C. Site testing shall include loop checkout.

### PART 2: PRODUCTS

(Not Used)

### PART 3: EXECUTION

### 3.01 SITE TESTING

- A. Loops
  - 1) Loop tests shall include the following:
    - a) Elevated Storage Tank Level
    - b) West Bee Caves Pump Station Pumps
    - c) Onsite Cla-valve

- d) Offsite Cla-valve
- e) EST high level alarm.
- 2) Each loop shall be tested from the element, i.e., switch, transmitter or relay, to the starter or control panel as applicable. The OWNER and ENGINEER shall witness all tests.
- 3) All loop checks shall be documented and submitted to the ENGINEER. Documentation shall include:
  - a) Loop name.
  - b) Loop description.
  - c) Termination information.
  - d) Drawing reference.
  - e) Type of test(s) performed.
  - f) Date tested.
  - g) Signature of tester and date.
  - h) Signature of OWNER and ENGINEER and date.
  - i) Problem description, if any.
- 4) 4. All loops found to contain defective or inoperable equipment shall be summarized on separate sheets and submitted to the ENGINEER and OWNER.
  - a) Work performed under this Contract shall be corrected and rechecked.
  - b) Correction of defective work by others shall be coordinated by the OWNER. Rechecking shall be performed as a part of this Contract.

### 3.02 MAINTENANCE OF OPERATIONS

- A. Field testing shall be scheduled through the Owner at least 7 days in advance.
- B. No testing that may affect operation shall be permitted without Owner's concurrence.
- C. No testing shall be performed on Monday or Friday.

### 3.03 TESTING PRECEDENTS

A. The following conditions shall be met prior to the start of any testing:

- 1) All documentation pertinent to the equipment being tested shall be on-site.
- 2) All spare parts, expendables and test equipment pertinent to the equipment being tested shall be on-site, labeled and properly stored.
- 3) All field equipment supplied and pertinent to the equipment being tested shall be operational.
- 4) Test schedules and test procedures shall have been submitted to and approved by the Owner.
- B. All test procedures and test results shall reflect information contained within the various operation and maintenance manuals furnished.

### 3.04 OWNER PARTICIPATION

- A. The Owner may participate in testing activities at its discretion.
- B. Owner's participation and use shall be such that it does not adversely affect specified testing requirements. No claim for delay shall be allowed unless the following conditions are met:
  - 1) The Owner and the ENGINEER are notified verbally that Owner actions could cause delay if continued.
  - 2) The Owner or the ENGINEER persists in the delay action.
  - 3) Written documentation is submitted to the ENGINEER within 24 hours that describes the Owner's action and impact.

**END OF SECTION** 

### SECTION 16010 ELECTRICAL GENERAL INFORMATION

- 8) Installation of an antenna at the top of the elevated tank and cable from the antenna to the local RTU. Antenna to be furnished by SCADA Contractor and installed by the Electrical Contractor.
- 9) Installation of a grounding/lightning protection system for the tank.
- 10) Installation of aviation obstruction lights on top of the tank.
- 11) Installation of a level transmitter as shown. Transmitter will be furnished by the SCADA Contractor and installed by the Electrical Contractor.
- 12) Installation of intrusion switches on the doors of the tank. Furnished by the SCADA Contractor and installed by the Electrical Contractor.
- 13) Installation of electrode probes in the tank bowl. Provided by the SCADA Contractor. Installed by the Electrical Contractor.
- 14) Programming the proposed PLC at the elevated storage tank and the additions to the PLC at the existing pump building. To be done by the City of Leander SCADA Contractor.
- 15) Programming and additions to the HMI at the central station. To be done by the Leander SCADA Contractor
- 16) Conduit, wiring, and accessories for the installation of power, lighting, grounding, instrumentation and control systems.

### 1.03 PLANS AND DRAWINGS

- A. The drawings indicate the general layout of the complete electrical systems and show arrangements of feeders, outlets, lighting fixtures, disconnect switches, panelboards and other work. The Contractor shall field verify scale dimensions since actual locations, distances and levels are to be governed by actual field conditions.
- B. The Contractor shall also check all other plans to avoid possible conflicts. Discrepancies shown on different plans or between plans and actual field conditions shall be brought to the attention of the Owner promptly for resolution.

### 1.04 SUBMITTALS

- A. Following the award of this contract, the Contractor shall submit pdfs of manufacturer data sheets, shop drawings, wiring drawings, etc., on the following items for approval:
  - 1) Power Center
  - Breaker added to existing switchboard.
  - 3) Wiring devices
  - 4) Wiring

- 5) Conduit Systems
- 6) RTU
- 7) Instruments.
- 8) Antenna
- 9) Obstruction lights.
- 10) Other electrical devices shown on the drawings or specified herein.

### 1.05 QUALITY ASSURANCE

- A. Materials and Substitutions: The materials and equipment supplied shall be new and of the best quality used in this type work. Where materials, equipment, apparatus or other products are specified by brand name, manufacturer type or catalog number, such designation is to establish standards of quality and style and shall be the basis of the bid. The Contractor shall submit any substitutions to the Engineer for consideration. In making such submittal, the Contractor shall bear the responsibility and all costs for any changes in the design necessitated by use of the substitution. All materials shall conform to NEMA or ANSI Standards, or both, where applicable.
- B. All materials shall also bear the Underwriters Laboratory label where such is available for the particular type product furnished. All materials shall be of domestic (U.S.A.) manufacturer.
- C. Workmanship: Workmanship shall be of the highest grade throughout and in accordance with the best standard practice. All work shall be performed by a Contractor who has had a minimum of five (5) consecutive years' experience in the construction of electrical, instrumentation and controls systems in water and wastewater plants of the same size and complexity as this project.

### 1.06 CODES AND PERMITS

A. All work shall be performed and all materials shall be in accordance with the National Electrical Code and all applicable Federal, State and local codes, regulations and ordinances. The Contractor shall, at his own expense, arrange for and obtain all necessary permits, inspections and approval by proper authorities in local jurisdiction of such work. All costs in obtaining such fees shall be borne by the Contractor.

### 1.07 TEMPORARY SERVICES

A. The Contractor shall arrange for, furnish, install and maintain temporary electrical service at site as required and remove the same after construction is completed. All temporary services shall be installed in accordance with OSHA Standards.

### 1.08 RELATION TO OTHER WORK

A. The electrical work shall be coordinated with the work of all associated trades and shall be installed in such a manner as to avoid conflicts with piping, structures and equipment being furnished or installed by other trades.

### 1.09 RECORDS FOR OWNER

- A. Keep a set of Drawings on the job, noting daily all changes made in these Drawings in connection with the final installation and turn over a clean, neatly marked set of sepia reproducible Drawings showing "as-installed" work to the Engineer for subsequent transmittal to the Owner. Accurately locate all underground utilities and services and systems and dimension on the "as-built" Drawings. Contractor shall maintain a set of "blue-line" prints in the Field Office for the sole purpose of recording "installed" conditions.
- B. In addition to the above, the Contractor shall accumulate during the progress of the job the following data, prepared in a neat brochure or packet folder and turn over to the Engineer for review, and subsequent delivery to the Owner:
  - 1) All warranties and guarantees and manufacturers' directions on equipment and material covered by the Contract.
  - 2) Operating and maintenance manuals prepared in accordance with the General Conditions.
  - 3) Approved wiring diagrams and control diagrams representing "as-built" conditions.
  - Copies of approved Shop Drawings.
  - 5) Any and all other data and/or Drawings required during construction.
  - 6) Repair parts lists of all major items and equipment including name, address and telephone number of local supplier or agent.
  - 7) Submit all of the above data to the Engineer for approval at such time as the Contractor asks for his last estimate.

### 1.10 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Prepare complete sets of operating and maintenance manuals for each item of equipment. Conform to the requirements of all contract documents. Include all certified Shop Drawings.
- B. In addition to the above, provide the services of a competent technician acceptable to the Engineer to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. Provide these instructions for a period of sufficient duration to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, acknowledged by the Owner, stating the dates of instruction and the personnel to who instructions were given. The Contractor is responsible for proper maintenance until the instructions have been

- given to the Owner's maintenance personnel and the letter of release acknowledged.
- C. Provide additional diagrams, operating instructions, etc., as specified hereinafter in the other sections of these Specifications.

### 1.11 MATERIAL AND EQUIPMENT SCHEDULES

- A. Refer to both Drawings and Specifications for schedules. Where reference is made to items "scheduled on Drawings", or "scheduled in Specifications", same shall include schedules contained in both the Drawings and Specifications. The Contractor's attention is directed to the various Specification Sections and Drawings for schedules.
- B. Refer to the Equipment List in these Specifications for a list of approved manufacturers of the various items of electrical equipment.

### 1.12 FINAL INSPECTION

- A. Personally conduct a careful inspection trip as a whole, assuring that the work on the project is ready for final acceptance, before calling upon the Engineer to make a final inspection.
- B. In order not to delay final acceptance of the work, have all necessary bonds, guarantees, receipts, affidavits, etc., called for in the various articles of this Specification, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and deliver the same to the Engineer at or before the time of final inspection. Check over each bond, receipt, etc., before preparing same for submission to see that the terms check with the requirements of the Specifications.
- C. The final inspection will be made jointly by the Engineer and the Owner.

### 1.13 GUARANTEE

A. Guarantee, for a period of one year, the electrical work installed to be free from defects of workmanship and material, and furnish and pay for all labor and materials required to fulfill this guarantee. The guarantee period shall begin with the date of occupancy and use of the systems.

### PART 2: PRODUCTS

### 2.01 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Storage at Site: Do not receive material or equipment at the job site until there is suitable space provided to properly store and protect equipment from rust, drip, humidity and dust damage.
- B. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of start-up or other overload conditions.
- C. Conformance to Agency Requirements: Where materials or equipment is specified to

be approved, listed or labeled by the Underwriters' Laboratories, Inc., or labeled, constructed and/or tested in accordance with the standards of NEMA and ANSI, the Contractor shall submit proof that the items furnished under this Section of the Specifications conform to such requirements. The label of the U.L., Inc., applied to the item will be acceptable as sufficient evidence that the items conform to such requirements.

- D. Manufacturer's Nameplates: Provide each major component of equipment with the manufacturer's name, address and catalog number on a stainless steel plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.
- E. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the structures and to the work of all trades. Visit the premises and become thoroughly familiar with all details of the work and working conditions. Verify all dimensions in the field, and advise the Engineer of any discrepancy before performing any work. Make all adjustments to the work required in order to facilitate a coordinated installation at no additional cost to the Owner or the Engineer.
- F. Submit additional data as requested by the Engineer on items designated in each section or as requested by the Engineer following award of contract.

### 2.02 IDENTIFICATION AND LABELING

- A. Clearly mark all items of equipment using engraved nameplates as hereinafter specified. Use 3 ply laminated plastic nameplates, a minimum of 3/32" thick, with white letters on black background. Use Roman Gothic letters of a size that is legible and appropriate to the application (3/16" minimum). Attach nameplates with a minimum of two (2) brass or stainless steel screws. Rivets or adhesives are not acceptable.
- В. Electrical equipment to be identified includes: all switchgear, distribution panels, transformers, motor control centers, panelboards, disconnect switches, starters, contactors, time switches, control panels, etc.
- C. Give voltage characteristics on nameplates on distribution panels, motor control centers and panelboards.

Example: PANEL LV 120/240V, 1 PH, 3 W

- Individual circuit breakers in distribution panels, individual units in motor control D. centers, individual disconnecting means, and individual motor starters, shall have nameplates describing the load served.
- E. Provide blank nameplates mounted on each spare or bussed space in motor control centers, and on each spare or space in distribution panels.
- F. Branch circuit panelboards shall have neatly typed circuit directories behind clear plastic. Identify circuits by room numbers or floor areas. Room numbers shall be those

- finally selected by the Owner, not necessarily those given on contract drawings. Spares and spaces shall be indicated with erasable pencil, not typed.
- G. Provide identification strips for all terminal blocks, marked in compliance with the applicable Plans. Identify wiring at the terminal block to match the same.
- H. All power wiring (120 VAC and above) shall be color coded per Austin Energy and WTC PUA standard color code.
- I. Identify all lights, switches, pushbuttons and other devices on the control panel and all relays and other devices inside the panel with nameplates complying with this Section.

### PART 3: EXECUTION

### 3.01 MANUFACTURER'S RECOMMENDATIONS

A. Follow the manufacturer's published directions in the delivery, storage, protection, installation, and wiring of all equipment and material. Promptly notify the Engineer, in writing, of any conflict between the requirements of the Contract Documents and the manufacturers' directions, and obtain the Engineer's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturers' directions or such instructions from the Engineer, he shall bear all costs arising in connection with the deficiencies.

### 3.02 SPACE AND EQUIPMENT ARRANGEMENT

- A. The size of electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers will be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space allotted. Fabrication drawings shall be prepared when required to indicate a suitable arrangement.
- B. Install all equipment in a manner to permit access to all surfaces.

### 3.03 PROTECTION

- A. At all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This includes erection of temporary shelters and supports where required to adequately protect any items stores from the weather, the ground and the surrounding work; cribbing of any items above the floor of the construction; and covering of items in the incomplete building with tarpaulins or other protective covering; installation of electric heaters in electrical switchgear and similar equipment to prevent moisture damage. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.
- B. Take particular care not to damage other construction in performing work. Cover all finished floors, step treads and finished surfaces to prevent any damage by workmen or their tools and equipment during the construction of the building.

### 3.04 ELECTRICAL WIRING OF MOTORS AND EQUIPMENT

- A. Wire all interconnecting wiring for the installation of power. Unless otherwise noted, provide all disconnect switches as required for proper operation, as indicated on the drawings, and required by applicable code.
- B. Provide complete wiring diagrams indicating power wiring and interlock wiring. Submit diagrams to the Engineer for review within fifteen (15) days after the submittals for equipment have been reviewed. Diagrams shall be based on accepted equipment and shall be complete full phase and interlock control drawings, not a series of manufacturer's individual diagrams.
- C. Note that the electrical design and drawings are based on the equipment scheduled and indicated on the drawings, and should any mechanical equipment requiring changes to the electrical design be furnished, the required electrical changes shall be made at no cost to the Owner, Architect or Engineer.

### 3.05 CUTTING AND PATCHING

- A. General: Cut and patch walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.
- B. Methods of Cutting: Make openings cut through concrete and masonry with masonry saws and/or core drills and at such locations acceptable to the Engineer. Do not use impact-type equipment except where specifically acceptable to the Engineer. Core drill openings in precast concrete slabs exact size.
- C. Restore all openings to "as new" condition under the appropriate Specification Section for the materials involved, and match remaining surrounding materials and/or finishes.
- D. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Provide adequate supports during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Engineer.
- E. Plaster: All mechanical work in areas containing plaster shall be complete prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.
- F. Special Note: Do not undertake any cutting, coring or excavating which will weaken the structure.

### 3.06 COOPERATION AND CLEANUP

A. Cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, properly store all tools, equipment and materials and clean all debris from the job. Upon the completion of the job, immediately remove all tools, equipment, and surplus materials and all debris caused by the work.

### 3.07 CLEANING AND PAINTING

- A. Paint all equipment, conduit, etc., furnished and installed in exposed areas. Comply with Specification on painting.
- B. Equipment is to be delivered to the job with suitable factory protective finish and painted, after installation, a color hereinafter specified.
- C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.
- D. Electrical switchgear, disconnect switches, panelboards, contactors, etc., with suitable factory applied finished shall not be repainted. Where factory applied finishes are damaged in transit, storage or installation, or before final acceptance, they shall be restored to factory-fresh condition by competent refinishers using a spray process and factory-furnished paint to match.

### 3.08 OBSTRUCTIONS

- A. The Drawings indicate certain information pertaining to surface and sub-surface obstructions which have been taken from Owner's drawings. This information is not guaranteed, however, as to accuracy of location of complete information.
- B. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies and other interested parties that all available information has been provided, and verify locations given.
- C. Should obstruction be encountered whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown on the Drawings.
- D. Where obstructions encountered are beyond the scope of work shown or specified in this project, refer the matter to the Owner's representative, and a cost differential proposal will be agreed upon before the added work is undertaken.

**END OF SECTION** 



## Elevated Storage Tank at the San Gabriel Pump Station

### **Geotechnical Investigation**

Elevated Water Storage Tank | Leander, Texas

Document No. 1 | Version 1 | Final

December 7, 2020

K Friese & Associates, Inc.



### **Document Information**

Project Title	Elevated Storage Tank at the San Gabriel Pump Station
Project Type	Elevated Water Storage Tank
Document Type	Geotechnical Investigation
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Fugro Document No.	Document No. 1
Version Number	1
Version Status	Final
Fugro Legal Entity	Fugro USA Land, Inc.
Issuing Office Address	8613 Cross Park Drive, Austin, TX 78754-4565

### **Client Information (Agent of Owner)**

Client	K Friese & Associates, Inc.
Client Address	1120 S. Capital of Texas Highway, City View 2, Suite 100, Austin, Texas 78746
Client Contact	Dale Murphy, P.E., Vice President
Client Document No.	

### **Version History**

VER	Date	Status	atus Comments on Content		Checked By	Approved By
1	December 7, 2020	Final	Geotechnical Investigation Report	GSB	AKD	РНВ

### **Project Team**

Initials	Name	Role
PHB	Peter H. Bush, P.E.	Project Principal
AKD	Amal K. Dutta, Ph.D., P.E.	Senior Geotechnical Engineer
GSB	Gus S. Boehme, E.I.T.	Graduate Engineer





**FUGRO USA** 

Fugro USA Land, Inc. 8613 Cross Park Drive Austin, TX 78754 USA

K Friese & Associates, Inc. 1120 S. Capital of Texas Highway City View 2, Suite 100 Austin, Texas 78746 Report No. 04.00177602 December 7, 2020

Attn: Mr. Dale Murphy, P.E., Vice President

## Geotechnical Investigation Elevated Storage Tank at the San Gabriel Pump Station Leander, Texas

Mr. Murphy:

Submitted herewith is the report of the Geotechnical Investigation for the proposed 1.25MG composite elevated water storage tank to be constructed at the San Gabriel Pump Station facility in Leader, Texas. In brief, the report includes a plan of borings, boring logs with results of laboratory tests, and descriptions of subsurface conditions. Based on the findings, geotechnical recommendations are set forth for the foundation design and construction of the proposed water storage tank.

Fugro appreciates the opportunity to provide these geotechnical engineering services to K Friese & Associates. We look forward to our continued association.

Sincerely,

FUGRO USA LAND, INC.

TBPE Firm Registration No. F-299

Gus S. Boehme, E.I.T.

Graduate Engineer

Amal K. Dutta, Ph.D., P.E.

Senior Geotechnical Engineer

AKD/GSB/lt(w\g\p\2020\R04.00177602)
Attachments

Distribution:

K Friese & Associates (Murphy) (1) (email)

File (1)

**T**UGRO

### **Contents**

**Boring Logs** 

Keys to Terms and Symbols Used on the Boring Logs

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### 1. INTRODUCTION

On October 20, 2020, Fugro USA Land, Inc. (Fugro) initiated the geotechnical investigation for the proposed 1.25MG composite elevated water storage tank to be located at the San Gabriel Pump Station facility in Leander, Texas. According to the information provided by Mr. Dale Murphy, P.E., with K Friese & Associates, Inc., the proposed tank will be approximately 135 ft in height with a pedestal diameter of about 40 feet. The total design load will be about 14,000 kips, the wind moment will be 12,000 kip-ft, and shear load will be 150 kips. The project site is located approximately 0.2 miles southwest of the intersection of Ronald Reagan Boulevard and CR 274 in Leander, Texas as shown on the Vicinity Map, Plate 1. A site plan provided by the Client, showing the proposed tank location near the pump station facility is shown on Plate 2.

### 2. AUTHORIZATION

The geotechnical investigation was authorized by Mr. Thomas M. Owens, P.E., of K Friese & Associates, Inc., with issuance of the Subcontract for Professional Services (KFA No. 0749) dated September 28, 2020. The subcontract includes Fugro's proposal No. 04.00116117, dated July 2, 2020 as Attachment A. The proposal outlines the scope of our services for this project.

### PURPOSE AND SCOPE

The purpose of the investigation was to obtain subsurface information adequate for (1) recommendation of suitable foundation types for the proposed elevated storage tank structure, (2) the formulation of design criteria for the type of foundations selected, and (3) the selection of materials and compaction requirements for earth construction.

The scope of the investigation included 1) a field investigation for determining subsurface conditions and obtaining representative samples for classification and testing, 2) a laboratory testing program to aid in the classification of the substrata and to provide parameters for selected foundation criteria, and 3) engineering analyses and evaluations of the results of the field and laboratory data to aid in assessing the geology, foundation design and geotechnical construction issues.

Field sampling, laboratory testing, and soil classifications and descriptions were in general accordance with methods, procedures, and practices set forth by the American Society for Testing and Materials, 2020 Annual Book of ASTM Standards, where applicable.



### 4. FIELD INVESTIGATION

As requested, the field investigation consisted of drilling a total of four (4) borings to a depth of 45 feet each below existing grade, where:

- One (1) boring (designated as Boring B-1) was drilled at the center of the proposed composite elevated storage tank; and
- Three (3) borings (designated as Borings B-2 through B-4) were drilled equally spaced on the anticipated support wall diameter.

The approximate locations of the borings are shown on the Plan of Borings, Plate 3. Boring locations were established by the Client and adjusted by Fugro in the field in areas to avoid existing structures and/ or underground utilities.

Detailed descriptions of subsurface materials encountered at the boring locations are presented on the Logs of Borings, Plates 4 through 7. A Key to Terms and Symbols used on the logs is set forth on Plate 8 and 9. Standard Penetration Test N-values in blows per foot (bpf) and rock core recovery and Rock Quality Designation (RQD) values in percent (ASTM D 6032), are shown on the logs of borings at the respective test depth. Groundwater observations made during drilling are also presented on the boring logs.

Ground surface elevations shown on the boring logs were interpolated from USGS 10-foot contour maps and estimated to the nearest 1-foot and should be considered approximate. Latitude and longitude GPS coordinates were obtained at the boring locations using a hand-held GPS device accurate to about 3 horizontal meters and are presented in the notes on the bottom of the boring logs. Groundwater notes are also presented at the bottom of the boring logs.

The borings were drilled with a truck-mounted drill rig equipped with 1) continuous flight augers for advancing the holes dry and recovering disturbed samples (ASTM D 1452), 2) split-barrel samplers and drive weight assembly for obtaining representative samples and measuring the penetration resistance (N values) of non-cohesive or semi-cohesive soil strata (ASTM D 1586), and 3) double-tube wireline core barrels equipped with diamond bits for obtaining 2-inch diameter rock cores (ASTM D 2113).

### 5. LABORATORY TESTING

The laboratory testing program included identification and classification testing of all strata encountered in the subsurface. Soil classifications tests, including Atterberg-limit determinations (ASTM D 4318) and partial grain-size analyses (ASTM D 422) were conducted on representative soil samples. To determine compressive strength, and unconfined compression tests (ASTM D 7012) were performed on selected intact rock samples. The classification and compression tests included natural water content determinations (ASTM D 2216). The compression tests also included unit dry weight determinations. The results of the tests are tabulated on the boring logs at the sample recovery depths.



### 5.1 Strata Descriptions

Descriptions of strata made in the field at the time the borings were drilled were modified in accordance with results of laboratory tests and visual examination in the laboratory. All recovered soil samples were examined and classified in general accordance with ASTM D 2487 and described as recommended in ASTM D 2488. Rock strata were classified in general accordance with "Rock Classification and Description", Chapter 1, Section 5, NAVFAC DM-7. Classifications of the soils and finalized descriptions of both rock and soil strata are shown on the boring logs.

### SITE AND SUBSURFACE CONDITIONS

### 6.1 Site Physiography

The project site is located approximately 0.2 miles southwest of the intersection of Ronald Reagan Boulevard and CR 274 in Leander, Texas. The site of the proposed composite elevated storage tank is currently cleared of vegetation and is to be constructed within the area of the nearby San Gabriel Pump Station. The proposed area is generally flat with ground surface elevation ranging from 974 feet to 977 feet, gradually sloping from the proposed center of the elevated storage tank.

### 6.2 Mapped Geology

According to published geologic mapping<sup>2</sup>, the site is underlain by soils and rock of the early Cretaceous age consisting of the Edwards Formation further underlain by Comanche Peak Formation. A discussion of the two geologic units is provided in the following subsections.

The Edwards limestone consists of relatively soft to extremely hard limestone, dolomitic limestone and dolomite. The harder limestone is vuggy, honeycombed and porous; oftentimes having solution cavities and voids sometimes open, sometimes clay-filled. The dolomite and dolomitic limestone of the Edwards is typically softer and when exposed to weathering may take on a soil-like consistency.

Comanche Peak limestone consists of fine-grained, moderately hard limestone and dolomitic limestone that is extensively burrowed. The unweathered limestone is typically gray to light gray in color and weathers white.

### 6.3 Site Stratigraphy and Engineering Properties

Subsurface conditions can best be understood by a thorough review of the Boring Logs presented on Plates 4 through 7. In general, the site is characterized by fill material, underlain by silty, clayey sands with gravel

Barnes, V.E., (1974) Geologic Atlas of Texas, Austin Sheet, Bureau of Economic Geology, The University of Texas at Austin, Austin, Texas.



<sup>1</sup> U.S. Navy (1971), Design Manual - Soil Mechanics, Foundations, and Earth Structures, NAVFAC DM-7.

and sandy, silty clays with gravel, further underlain by limestone of the Edwards and Comanche Peak Formations.

Surficial fill material described brown to tan sandy clay with crush limestone was encountered at the surface and extended to depths of about 2 to 3.5 ft below ground surface. The fill material is likely from temporary grading during the construction of the nearby pump station.

Beneath the fill materials semi-cohesive soils described as sandy, silty clay with gravel and silty, clayey sands with gravel were encountered and extended to the depths of 4.5 to 8.5 ft below ground surface. Measured liquid limits of the soil strata ranged from 25 to 26, plasticity indices ranged from 4 to 5, and percent fines (material passing the No. 200 sieve) ranged from 24 to 53. Standard Penetration N-values ranged from 22 blows per foot (bpf) to 50 blows over the penetration of 4 inches indicating medium dense to very dense consistency.

Underlying the semi-cohesive soils was limestone of the Edwards Formation and depths of 16 to 19 ft below ground surface. The tan, moderately to highly weathered limestone described as hard to very hard and highly fractured, and dolomitic. Rock core recovery of the limestone stratum ranged from 63 to 100 percent, and Rock Quality Designation ranged from 0 to 52 percent. Two unconfined compressive strengths of intact limestone core samples measured 268 to 309 tsf, indicating very hard limestone. In Boring B-3 a 2-foot open void was encountered within the Edwards limestone strata at a depth of about 11 ft below the existing ground surface. Open voids within the Edwards limestone are oftentimes encountered and need to be taken into account during the design and installation of the foundations.

Limestone of the Comanche Peak Formation was encountered beneath the limestone of the Edwards Formation and extended to the boring termination depths of 45 feet. The gray limestone is described as hard to very hard and moderately fractured. Rock core recovery of the limestone stratum ranged from 47 to 100 percent, and Rock Quality Designation ranged from 13 to 93 percent. Unconfined compressive strengths of intact limestone core samples ranged from 104 to 181 tsf, indicating hard limestone.

### 6.4 Groundwater

Groundwater was not encountered in the borings during dry advancement. Air rotary with foam injection methodology was used in coring of the limestone. It is possible that seasonal variations in response to rainfall, flooding, irrigation, seasonal cycles, surface drainage modifications, and other factors, will cause fluctuations in the groundwater level. Additionally, perched water may be encountered in discontinuous zones and cracks within the limestone. One should note that the direct groundwater observations reported herein are very short term and should not be interpreted as a "groundwater study".



### 7. FOUNDATION DESIGN RECOMMENDATIONS

The types and bearing depth of foundations suitable for a given structure primarily depend on several factors including the subsurface conditions, the function of the structure, the loads it may carry, the cost of the foundation, and the criteria set by the Design Engineer with respect to vertical and differential movement which the structure can withstand without damage.

As discussed previously, the provided information by the Client indicated the proposed tank will be approximately 135 ft in height with a pedestal diameter of about 40 feet. The total design load will be about 14,000 kips, the wind moment will be 12,000 kip-ft, and shear load will be 150 kips.

It is to be noted that in addition to the four (4) borings performed as part of our current field exploration Fugro previously performed two geotechnical field investigations near and on the project location for the City of Leander and the results of these studies were provided in the following two reports:

- Geotechnical Investigation, San Gabriel Pump Station;
  - Fugro Report No. 04.30171012, published November 14, 2017
- Geotechnical Investigation, Kauffman Loop Elevated Storage Tank;
  - Fugro Report No. 04.30151029, published August 12, 2016

To evaluate the subsurface conditions at the proposed San Gabriel Elevated Storage Tank site, the boring information from the above mentioned historical reports were also considered.

Based on our understanding of the proposed construction and subsurface conditions encountered at the site, the 1.25MG elevated storage tank may be supported on either a shallow foundation such as reinforced concrete circular mat or ring-shaped foundation bearing in weathered limestone of the Edwards formation or a deep foundation consisting of drilled shafts bearing in the Comanche Peak limestone. It is to be noted that our field exploration program indicated the presence of open voids on the order of about 2 ft in Boring B-3 within the depth ranges 11 to 13 ft below ground surface. Additionally, based on our historical geotechnical investigations as discussed above, the presence of clay-filled voids were also observed in Edwards limestone at depths ranging from 16 to 23 ft below ground surface. Therefore, a void mitigation program as discussed in this report is required for shallow foundation design. Specific foundation recommendations for both shallow and deep foundations are provided in the following sections.

### 7.1 Shallow Foundation Recommendations

The shallow foundation should bear at a minimum depth of 10 feet below ground surface in the tan highly weathered limestone. Shallow foundations can be taken deeper to avoid the open voids found in Boring B-3. A void mitigation program associated with the shallow foundation system shall be implemented regardless of the bottom-of-foundation elevation. The following sections present our recommendations



for excavation and subgrade preparation, void mitigation, allowable bearing pressure, modulus of subgrade reaction, resistance to uplift and lateral loads and backfilling.

**Excavation and Subgrade Preparation:** The bottom of the excavation for the foundation should expose hard, tan highly weathered limestone. Any loose or disturbed materials encountered at the bottom of the excavation should be removed. There should also not be any free water standing in the excavation. Clay layers or rock defects should be over-excavated and replaced with lean concrete (concrete having a minimum compressive strength of 3,000 psi at 28 days), if necessary. The exposed subgrade should be observed by the geotechnical engineer prior to reinforcing steel placement. A leveling pad or "mud mat" consisting of 4 inches of lean concrete may be placed to facilitate construction.

Excavation through the surficial silty, clay sand or sandy, silty clay should proceed without significant difficulty. Advancement through the tan limestone will proceed with greater difficulty. Assessments of rippability, based on inspection of cores and measured unconfined compressive strengths of 268 and 309 tsf indicated that the very hard, tan limestone is marginally rippable. Excavation into the limestone will require use of heavy duty track-mounted rock excavation equipment, rock trenchers, and hoe-rams.

Void Mitigation: As discussed previously, open voids on the order of about 2 ft were observed in the limestone, in Boring B-3 within the depths ranging from 11 ft to 13 ft below ground surface. Additionally, based on our historical borings at the nearby sites, clay-filled voids on the order of about 1 to 2.5 ft were observed in the Edwards limestone at depths ranging from about 16 to 23 ft below ground surface. Voids and other karst features are random in the Edwards Limestone. Therefore, it is possible that upon excavation to foundation depths, groundwater, open or clay-filled voids, solution zones, or other rock defects may be encountered or be hidden below the exposed surface. A series of small diameter holes, generally 4 to 6 inches in diameter or larger, to probe the subgrade to assess the extent and depth of voids will be required to further assess the subgrade conditions for shallow foundations. The probe holes should have center-to-center spacing of no more than 5 ft and should penetrate at least 25 ft below ground surface, approximately 15 ft below the bearing elevation of the shallow foundations. In the event that voids are encountered in the probe holes, the voids should be structurally mitigated by backfilling with concrete or by a compaction grouting program. Some voids may be large. An Environmental Geologist or Engineer should be consulted prior to implementing the compaction grounding program. The geotechnical engineer should observe the probe holes and determine structural mitigation measures. A contingency budget should be established for additional excavation and backfilling of the tank foundations. Additionally, a qualified environmental consultant should be retained to address environmental mitigation protocol.

**Net Allowable Bearing Pressure**: The tank may be supported by a circular mat or ring-shaped foundation bearing at least 10 ft below existing grade and at least 3 ft into weathered limestone (whichever is deeper).



The foundation may be designed for a net allowable bearing pressure of 6,000 psf (Factor of Safety of 3.0) provided rock defects, solution zones and voids encountered in the probe holes or mass excavation are mitigated as recommended herein. The footing should be proportioned so that the maximum contact pressure under the combined effects of dead and live loads does not exceed the net allowable bearing pressure. Transient loads (wind loads) may exceed the allowable by a factor of 1.3.

**Modulus of Subgrade Reaction**: The modulus of subgrade reaction is the ratio between unit soil pressures and the corresponding deflection or settlement. The modulus of subgrade reaction can be estimated from the allowable bearing pressure<sup>3</sup>. If a modulus of subgrade reaction is required for the design of the foundation, use a value of 200 pci.

**Resistance to Uplift Loads:** The ultimate resistance of a shallow foundation to uplift loads is limited to the weight of the foundation plus the weight of any soil directly above the foundation. We have not had specific discussion with the tank designers, however, based on our experience with similar size tanks, we expect that the foundation will be on the order of 10-ft thick to resist uplift and overturning loads. The tank design engineers should apply an appropriate factor of safety to the ultimate uplift resistance.

**Resistance to Lateral Loads:** Horizontal loads acting on the foundations will be resisted by friction between the foundation material and the base of the foundation, and passive earth pressure of soil in contact with the outer face of the foundation. For design purposes, the resistance due to passive soil pressure should be neglected. For concrete foundation in good contact with the tan, weathered limestone, an allowable coefficient of friction of 0.5 may be used to resist sliding.

**Backfill:** The backfill around or in the interior of the foundation, but not below the footing or mat, should consist of a material that classifies as a CL, SC, or GC in accordance with the Unified Soil Classification System and have a PI less than 15. The fill should be placed in 6-inch (compacted) lifts or less and compacted to at least 95 percent of the maximum dry density as determined using TxDOT Test Method TEX-113-E. Maintain water contents to within  $\pm 2\%$  of the optimum.

### 7.2 Drilled Shaft Design Recommendations

The elevated water storage tank could also be supported by drilled shaft foundations. The straight-sided drilled shafts should be designed in accordance with the following:

1. Drilled shafts should be embedded at least 5 ft into the gray limestone of the Comanche Peak Formation, with a minimum shaft length of 30 ft below existing grade of final design grade, whichever is deeper. The drilled shaft should be sized using an allowable end bearing capacity of



Bowles, J.E., (1982), Foundation Analysis and Design, Third Edition, New York, New York, McGraw Hill, pp. 268.

- 18 ksf, and an allowable skin friction of 2 ksf between the shaft and the tan to gray highly weathered and slightly weathered limestone material, neglecting the upper 5 ft of shaft embedment into the highly weathered limestone, open voids and soft clay layers encountered in the limestone.
- 2. Where voids larger than one foot are encountered, Fugro should be immediately notified, as special design considerations may be involved. If casing is utilized to seal off a void from concrete loss, or prevent water intrusion, all side friction along areas where the casing is to remain must be neglected.
- 3. The diameter of straight-sided drilled shafts carrying structural loads should not be less than 24 inches. Shaft reinforcement extending from top to bottom should not be less than 1.0% of the gross area of the shaft.
- 4. The structural capacities of the shafts should be checked for allowable stresses in the concrete, total downward axial loads, tension forces, lateral forces, and moments produced by dead load plus probable maximum live loads.
- 5. Maintain a minimum clear spacing between drilled shafts of at least three shaft diameters. If any center-to-center spacing between adjacent drilled shafts are less than 3 diameters, the geotechnical engineer should be notified in order to evaluate any group action reduction that may be appropriate.
- 6. Settlements of properly constructed drilled shafts designed in accordance with these recommendations are estimated to be less than <sup>3</sup>/<sub>4</sub> inches.
- 7. For lateral load analysis, we recommend the following LPILE parameters for use by others in the lateral load analysis of deep foundations. The lateral pile resistance of the upper 5 feet of fill material and other soil should be neglected.

	Drilled Shaft Lateral Design Parameters								
Stratum	'p-y' Criteria	γ (pci)	<i>k</i> (pci)	c <sub>u</sub> (psf)	φ (deg)	E (ksi)	UCS (psi)	RQD (%)	<b>k</b> <sub>rm</sub>
Fill Material (Upper 5 feet)									
Silty, Clayey Sands (SC-SM/ CL-ML)	Medium Dense Sand w/o Water	0.065	90		32				
Limestone	Weak Rock	0.081				200	1,100	15	0.0005
Limestone	Weak Rock	0.081				400	1,500	40	0.0005
Soil Code = Internal Soil Type E = Elastic Modulus									•

 $\gamma'$  = Effective Unit Weight UCS = Unconfined Compressive Strength

k = Soil-Modulus Parameter for Sand RQD = Rock Quality Designation

 $c_u$  = Undrained Shear Strength  $k_{rm}$  = Weak Rock Mass Constant  $\phi$  = Angle of Internal Friction



### 7.3 Drilled Shaft Construction

- 1. Since some variation in drilled shaft depths may be required due to the character of the clay strata and the possible presence of weak zones or lenses, or other defects, contract documents should include pay items for constructing drilled shafts on a unit price basis.
- Contract documents should provide for the use of casing for proper installation of drilled shafts due to the presence of caving soil (medium dense sand layer and voids). A unit price for the use of casing should be clearly identified on the bid tabulation form in the contract documents.
- 3. In order to help obtain good shaft-to-rock bonding, it is recommended that drilled shaft concrete be specified as a high slump concrete (7 to 8-inches slump, preferably superplasticized), which still has the proper characteristics of normal concrete such as workability, durability, cohesiveness (will not segregate during placement), and strength.
- 4. To prevent deterioration of the sides and bottoms of shaft excavations, reinforcement and concrete should be placed the same day drilling operations are completed. Before placement, shafts should be inspected to assure bottoms are clean and relatively free of water and pier sidewalls are clean and free of drill cuttings.
- 5. Centralizing chutes, tremies, and/or concrete pumps may be necessary to prevent the concrete from striking the sides of reinforcement and thus segregating. The desired maximum free fall of concrete should be about 10 feet, but greater heights are allowable if segregation can be eliminated and if the shaft excavation is dry.
- 6. If temporary casing is used, when it is extracted, the head of concrete must be maintained at a level well above the bottom of the casing; we recommend 10 to 15 feet. To facilitate casing extraction, the slump of the concrete and the cleanness of the inside of the casing are critical items that the contractor must control. The top 10 ft of the drilled shaft concrete should be vibrated following placement.
- 7. The drilled pier operation should be inspected, on a full-time basis, by a qualified representative of the geotechnical engineer to: a) verify desired penetration into the bearing stratum, b) verify shaft dimensions and proper reinforcement, c) monitor cleanness and amount of water, if any in shaft excavations, d) monitor placement of concrete and use of tremie or pumps, e) monitor the extraction of casing, if used, and f) maintain accurate records.
- 8. As the design of any foundation relies heavily on generalizations drawn from subsurface conditions determined at a limited number of boring locations, verification of these generalizations at any given location should not be dictated by criteria based on depth or drilling resistance. Instead, the sides and bottoms of shafts should be examined by the



- geotechnical engineer of record to assure that shaft bottoms bear in the desired stratum, and that the sidewalls are adequate for the design skin friction values.
- 9. In addition to the construction recommendations contained herein, the shafts should be constructed in general accordance with ACI 336.3R, Chapters 4 and 5.

### 7.4 Seismic Design

For structural designs based upon the ASCE 7-16, the following Criteria will apply. Based on the soil boring information, the seismic site classification of the proposed site is Site Class B "stiff soil". The Mapped Spectral Response Acceleration at short periods ( $S_S$ ) is about 0.054g, and the Mapped Spectral Response Acceleration at a 1 second period ( $S_1$ ) is about 0.034g. Site Coefficients  $F_a$  and  $F_V$  are 0.9 and 0.8, respectively.

### 8. CONSTRUCTION ISSUES

### 8.1 Temporary Excavations and Support

If temporary sloping is feasible, the following suggestions set forth in the table on the following page are in accordance with OSHA<sup>4</sup> for classifying soil encountered in our investigation. Alternatives for sloping and benching for excavations deeper than 20 ft should be designed by a licensed professional engineer in the state of Texas. It is stressed that these are suggestions only for preliminary planning and estimating, and the excavation safety system design and implementation is solely the contractor's responsibility.

Soil/Rock Type	OSHA Classification	Recommended OSHA Slope
Surficial Soil (SC-SM, CL-ML)	Type C	1.5H to 1V <sup>(1)</sup>
Weathered or Jointed Limestone	Type B	1H to 1V
Competent Limestone	Stable Rock	Vertical sides <sup>(2)</sup>

### Notes:

- If groundwater is encountered, flatter slopes or a dewatering plan will be required to maintain excavation safety. This flatter slope will control the sloping of the excavation and should be continued to the ground surface
- 2. If faulting, jointing, and/or inclined discontinuities are exposed, flatter slopes will be required to maintain safe trench excavations. Assume Type A (¾H to 1V).

### 8.2 Surface and Groundwater Control

Positive drainage away from the excavation should be established to prevent surface water from ponding within the excavation during construction and around the completed foundation. Groundwater was not

<sup>&</sup>lt;sup>4</sup> Code of Federal Regulations, Title 29 Part 1926 (2003), "Labor", Occupational Safety and Health Administration, Department of Labor, Subpart P - Excavations, pgs. 373 – 410.



encountered during dry advancement of the borings drilled at this site. However, perched groundwater may be encountered during times of wet seasonal conditions. If groundwater seepage does occur in the construction excavation, this seepage can, more likely than not, be pumped from the excavation.

The contractor should be made aware of the potential presence of groundwater within the planned excavation depths. Contract documents should include a bid item for dewatering of the trench in order to facilitate proper pipe bedding and backfill placement. If groundwater is found to be excessive, the geotechnical engineer should be retained to observe the actual conditions and provide recommendations, if appropriate, for permanent drainage of groundwater in the bedding stone.

### CONDITIONS

Since some variation was found in subsurface conditions at boring locations, all parties involved should take notice that even more variation may be encountered between boring locations. Statements in the report as to subsurface variation over given areas are intended only as estimations from the data obtained at specific boring locations.

It is recommended that, upon completion of the plans and specifications and the incorporation of the recommendations herein, the geotechnical engineer be retained to review such plans to ensure proper interpretation and implementation of his recommendations, and in the interest of the best compromise between cost and performance.

The professional services that form the basis for this report have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in the same locality. No warranty, expressed or implied, is made as the professional advice set forth. Fugro's scope of work does not include the investigation, detection, or design related to the presence of any biological pollutants. The term 'biological pollutants' includes, but is not limited to, mold, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

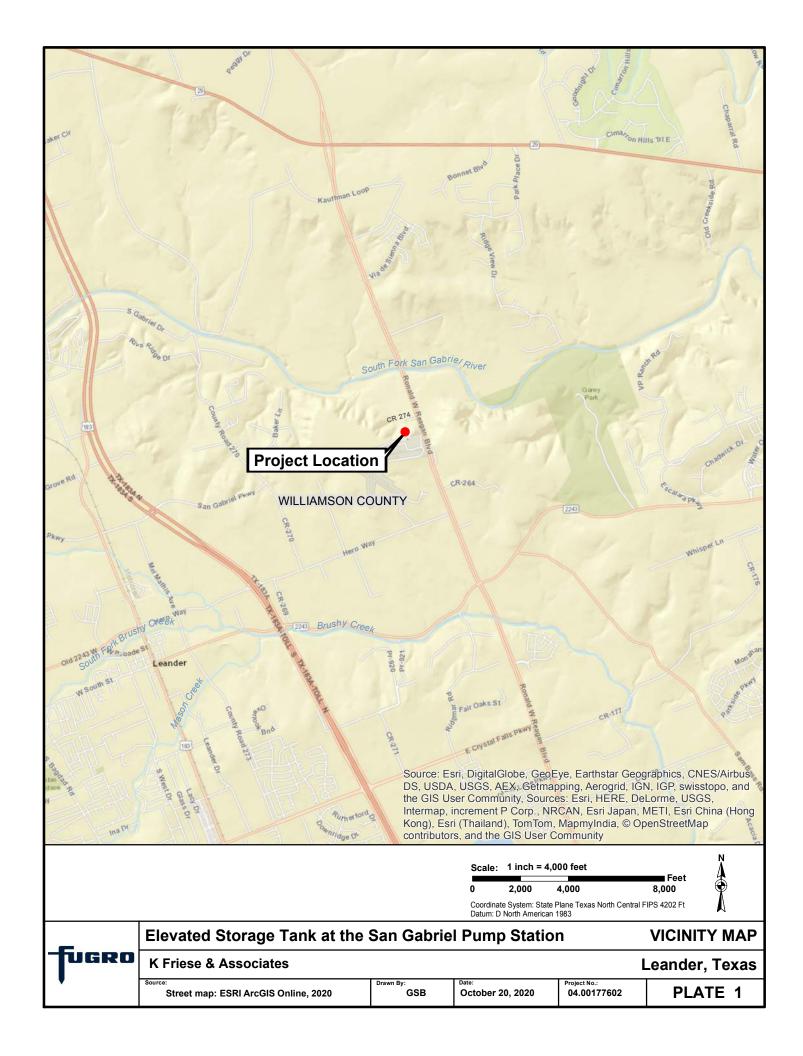
The results, conclusions, and recommendations contained in this report are directed at, and intended to be utilized within, the scope of work contained in the agreement executed by Fugro USA Land, Inc. and client. This report is not intended to be used for any other purposes. Fugro USA Land, Inc. makes no claim or representation concerning any activity or condition falling outside the specified purposes to which this report is directed, said purposes being specifically limited to the scope of work as defined in said agreement. Inquiries as to said scope of work or concerning any activity or condition not specifically contained therein should be directed to Fugro USA Land, Inc. for a determination and, if necessary, further investigation.

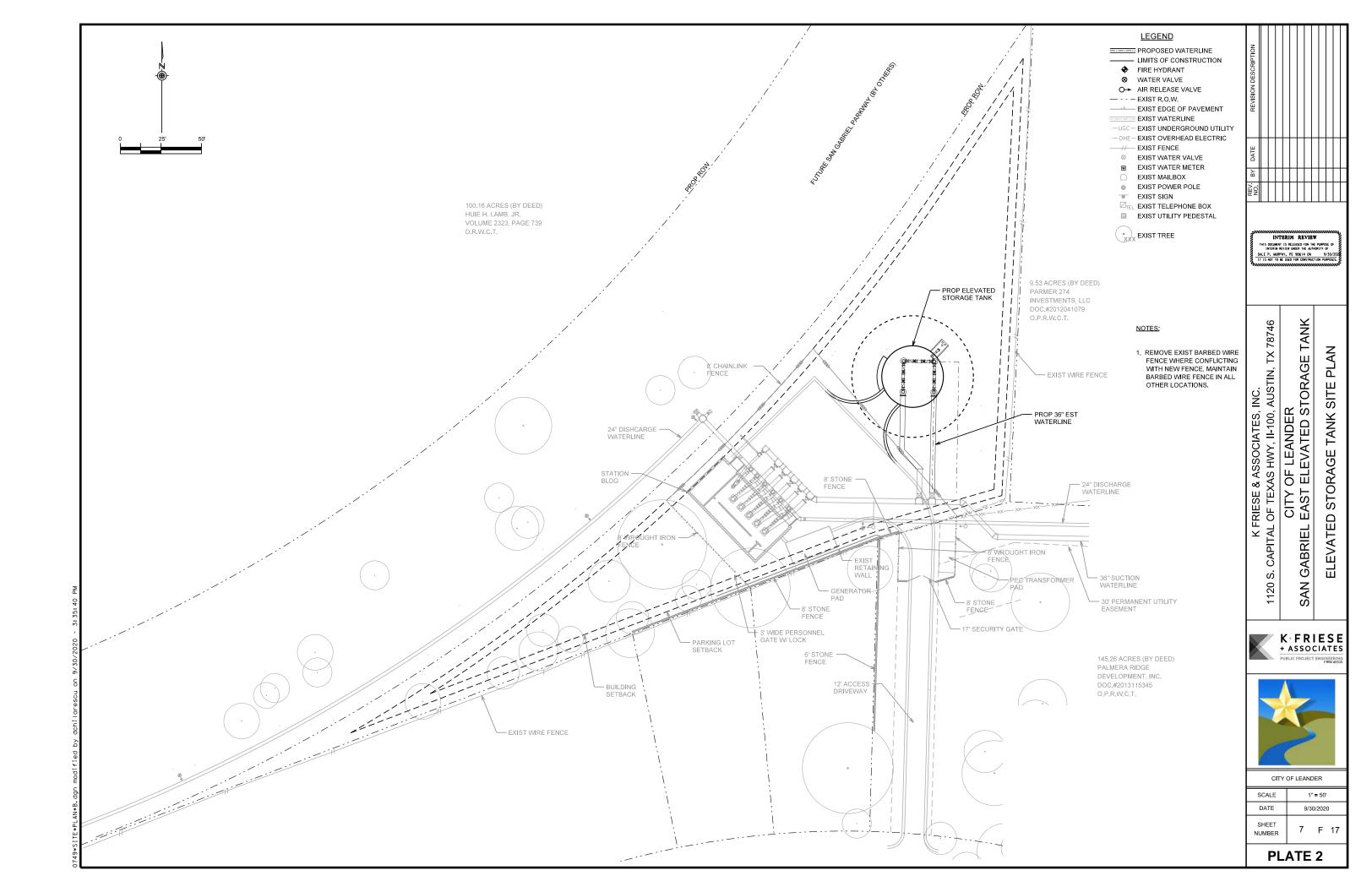
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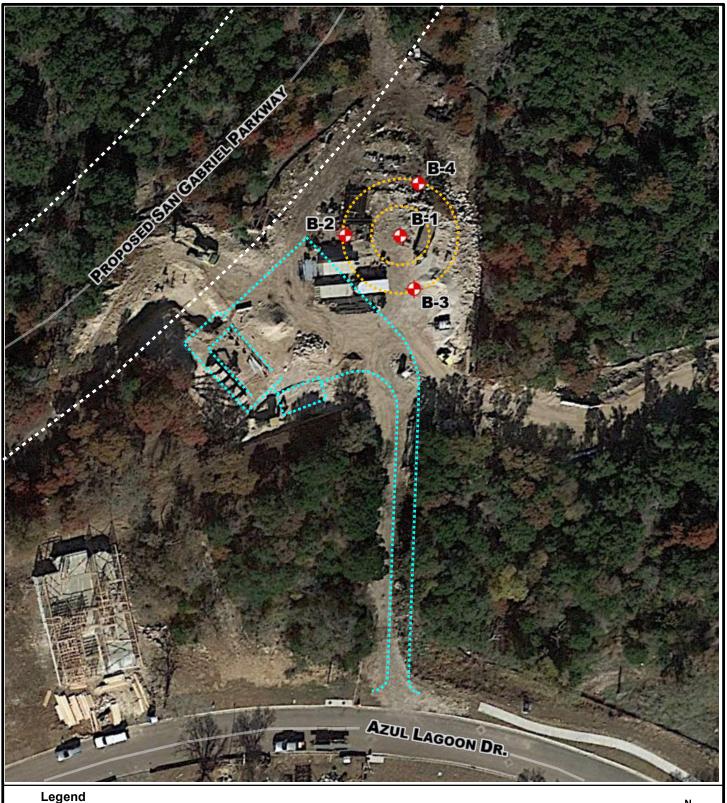


## **PLATES**











Proposed Elevated Storage Tank

Pump Station

Scale: Feet 0 25 50 100

Coordinate System: State Plane Texas Central FIPS 4203 Ft Datum: D North American 1983





**Elevated Storage Tank at the San Gabriel Pump Station** 

**PLAN OF BORINGS** 

K Friese & Associates

Leander, Texas

Orthophotography: Google Earth Pro, 2020

GSB

November 20, 2020

Project No.: 04.00177602

PLATE 3

# FUGRO STD PLATE (AUSTIN) 04.00177602 - ELEVATED STORAGE TANK AT SAN GABRIEL PUMP STATION.GFJ FUGRO AUSTIN DATA TEMPLATE.GDT 12/3/20

# LOG OF BORING NO. B-1 Elevated Storage Tank at the San Gabriel Pump Station Leander, Texas



N = 30 SANDY LEAN CLAY with crushed gravel, brown to tan, moist, (FiLL)  N = 506" SILTY, CLAYEY SAND with GRAVEL (SC-SM), light brown to tan, moist, very dense, with limestone fragments and occasional calcareous nodules.  S N = 504" LIMESTONE, light brown to tan, soft, highly weathered, moderately fractured, dolomatic. (Edwards)  10 10-15					Leander, Texas PROJECT NO. 04.001776	02	•		•		Fugro	USA L	and, Inc.
N=30 SANDY LEAN CLAY with crushed gravel, brown to tan, moist. (FilLt)  N=500F SILTY, CLAYEY SAND with GRAVEL (SC-SM), light brown to tan, moist, very dense, with limestone fragments and occasional calcareous nodules.  SN=504F LIMESTONE, light brown to tan, soft, highly weathered, moderately fractured, dolomatic. (Edwards)  10 I0-15  LIMESTONE, tan, highly weathered, highly fractured, moderately hard, with occasional clay seams.  (Edwards)  15 I15-30 weathered, w/ sandy clay layers from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  20	ОЕРТН, FT	SYMBOL	SAMPLES	POCKET PEN, tsf Blows/ft. REC./RQD, %		ELEV./	WATER CONTENT, %	LIQUID LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 4 SIEVE, %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	COMPRESSIVE STRENGTH TSF
moist. (FiLt)    N = 506"   SILTY, CLAYEY SAND with GRAVEL (SC-SM), light brown to tan, moist, very dense, with limestone fragments and occasional calcareous nodules.   S   N = 504"   LIMESTONE, light brown to tan, soft, highly weathered, moderately fractured, dolomatic. (Edwards)   10   10 - 15		XXX	k										
SILTY, CLAYEY SAND with GRAVEL (SC-SM), light brown to tan, moist, very dense, with limestone fragments and occasional calcareous nodules.  LIMESTONE, light brown to tan, soft, highly weathered, moderately fractured, dolomatic. (Edwards)  LIMESTONE, tan, highly weathered, highly fractured, moderately hard, with occasional clay seams. (Edwards)  LIMESTONE, tan, highly weathered, highly fractured, moderately hard, with occasional clay seams. (Edwards)  LIMESTONE, tan, highly weathered, highly fractured, moderately hard, with occasional clay seams. (Edwards)  LIMESTONE, gray, slightly increased foam injection used from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet. Or 10.0  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20 20-25 100 / 65 25-30 3 143 111(U	-	XX		N - 30									
brown to tan, moist, very dense, with limestone fragments and occasional calcareous nodules.  972.5  LIMESTONE, light brown to tan, soft, highly weathered, moderately fractured, dolomatic. (Edwards)  10  10-15' 83 / 0  11 26 4 85 47  11 26 4 85 47  967.0  967.0  10.0  10.0  10.0  10.0  15-20' - weathered, w/ sandy clay layers from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  20 20-25' 100 / 65  25-30' - 25-30' - 3 1143 111(U	-			N = 50/6"	OU TV OLAVEV CAND WHE CRAVEL (OC ON) BIRLY	+							
LIMESTONE, light brown to tan, soft, highly weathered, moderately fractured, dolomatic. (Edwards)  10  10-15 81/38  LIMESTONE, tan, highly weathered, highly fractured, moderately hard, with occasional clay seams. (Edwards)  15  15-20 73/13  LIMESTONE, tan, highly weathered, highly fractured, moderately hard, with occasional clay seams. (Edwards)  15-20 - weathered, w/ sandy clay layers from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  959.0  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20 22-25 100 / 85  3 143 111(U	-			N = 50/6"	brown to tan, moist, very dense, with limestone	2.0							
LIMESTONE, light brown to tan, soft, highly weathered, moderately fractured, dolomatic. (Edwards)  10	_				fragments and occasional calcareous nodules.	070.5	11	26	4	85	47		
moderately fractured, dolomatic. (Edwards)  10  10-15  10-15  83 / 0  10-15  10-15  83 / 0  10-15  10-15  10-15  10-15  10-15  10-15  10-15  10-15  10-15  10-15  10-15  10-15  10-15  10-16  10-15  10-15  10-16  10-15  10-16  10-16  10-10  1	_	///.l		N = 50/4"	LIMESTONE light brown to tan soft highly weathered	<del></del>							
10  10-15 LIMESTONE, tan, highly weathered, highly fractured, moderately hard, with occasional clay seams.  (Edwards)  15-20 -weathered, w/ sandy clay layers from 15 to 20 feet. Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  20  20-25 100 / 85  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  21 22-30 3 143 111(U	5 –					4.5							
10 10-15' LIMESTONE, tan, highly weathered, highly fractured, moderately hard, with occasional clay seams.  (Edwards)  15-20' 73/13 Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  20 20-25' 1007/65  1007/65  25-30' 3 143 111(U													
10.0 10.15' 83/0 LIMESTONE, tan, highly weathered, highly fractured, moderately hard, with occasional clay seams. (Edwards)  15-20' - weathered, w/ sandy clay layers from 15 to 20 feet. Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  20-25' 100 / 65  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  25-30' 3 143 111(U	-			81 / 38									
10.0 10-15' as 1	-												
10-15 as 10-			- -										
10-15' 83/0 LIMESTONE, tan, highly weathered, highly fractured, moderately hard, with occasional clay seams.  (Edwards)  15-20' - weathered, w/ sandy clay layers from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20-25' 100/65  25-30' 3 143 111(U						967.0							
moderately hard, with occasional clay seams.  (Edwards)  15-20 - weathered, w/ sandy clay layers from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  20- LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20- 25- 100 / 65  3 143 111(U	10			10'-15'	LIMESTONE, tan, highly weathered, highly fractured,	-							
15-20' - weathered, w/ sandy clay layers from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20-25' 100 / 65  25-30' 3 143 111(U	-			83 / 0		10.0							
- weathered, w/ sandy clay layers from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  959.0  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20'-25' 100 / 65  25'-30' 3 143 111(U			∄   -		(Edwards)								
- weathered, w/ sandy clay layers from 15 to 20 feet.  73/13  Pill Note: loss of stability, increased foam injection used from 15 to 20 feet.  959.0  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20-25  100 / 65  25-30  3 143 111(U)													
- weathered, w/ sandy clay layers from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  959.0  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20-25  100 / 65  25-30  3 143 111(U)	-												
- weatnered, w/ sandy clay layers from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  959.0  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20-25													
- weathered, w/ sandy clay layers from 15 to 20 feet.  Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  959.0  LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20'-25' 100 / 65  25'-30' 3 143 111(U													
Drill Note: loss of stability, increased foam injection used from 15 to 20 feet.  Solve the stability of the	15 –			15'-20'	- weathered, w/ sandy clay layers from 15 to 20 feet.								
20 - LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20'-25' 100 / 65  25'-30'  3 143 111(U	-		<b>.</b> ≡	73 / 13									
20 -25' 100 / 65 25'-30' LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  18.0  20-25' 100 / 65  25'-30' 3 143 111(U	•		<u>-</u>		from 15 to 20 feet.								
20 LIMESTONE, gray, slightly weathered, moderately fractured, moderately hard. (Comanche Peak)  20'-25' 100 / 65  25'-30'  3 143 111(U			.= -			050.0							
20 -25 100 / 65 25-30 fractured, moderately hard. (Comanche Peak)	-				LIMESTONE gray slightly weathered moderately	+							
20 - 20 - 20 - 20 - 25 - 100 / 65 - 25 - 30 - 3 - 143 - 111(U	_		Щ			10.0							
25-30' 3 143 111(U													
25 - 25'-30' 3 143 111(U	20 –		卅	20'-25'									
3     143   111(U	=		╢	100 / 65									
3         143   111(U		$\pm$	ᅦ										
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3     143   111(U		$\Box$	ᅦ										
		$\Box$	╣										
100/78	25 –		卌	25'-30'			3					143	111(U)
	-	$\Box$	╣	100 / 78									
	_												
	}	$\Box$											
	+												
	+	$\Box$	╢										
			$\exists \parallel$			<u> </u>	<u> </u>						
COMPLETION DEPTH: 45.0 KEY:					COMPLETION DEPTH: 45.0	ŒY:		_	_				
N = Standard Penetration Test, bpf					DATE DRILLED:	l = Standar				t, bpf			
P = Pocket Penetrometer, tsf  WATER LEVEL / SEEPAGE: See Notes U = Unconfined								omete	er, tsf				
UPON COMPLETION: See Notes Q = Unconsolidated Undrained Triaxial PLATE 4a					· · · · · · · · · · · · · · · · · · ·			ed Und	draine	d Triax	ial	Ы ν.	TF 42

### LOG OF BORING NO. B-1 **Elevated Storage Tank** at the San Gabriel Pump Station Leander, Texas PROJECT NO. 04.00177602

**UPON COMPLETION: See Notes** 



PLATE 4b

Fugro USA Land, Inc PLASTICITY INDEX (PI), % WATER CONTENT, % PASSING NO. 200 SIEVE, % PASSING NO. 4 SIEVE, % COMPRESSIVE STRENGTH TSF POCKET PEN, t Blows/ft. REC./RQD, % UNIT DRY WEIGHT, PCF DEPTH, FT SAMPLES LIQUID LIMIT, % SYMBOL STRATUM DESCRIPTION **LAYER** ELEV./ DEPTH SURF. ELEVATION: 977.0 ft± 30'-35' LIMESTONE, gray, slightly weathered, moderately 100 / 23 fractured, moderately hard. (Comanche Peak) (continued) - w/ shaley, clay layers from 30 to 35 feet. 35 35'-40' 2 140 142(U) 100 / 67 40 40'-45' 100 / 68 932.0 45 45.0 Notes: 1) The boring was advanced using dry augering to the depth of 6 feet. Beyond 6 feet, the boring was cored using air rotary with foam injection to the boring termination depth. Groundwater was not encountered during drilling. 2) Approximate GPS Coordinates: 50 30.60411°N. 97.81970°W 3) Surface elevation was interpolated from USGS topographical maps and should be considered approximate. 55 **COMPLETION DEPTH: 45.0** KEY: N = Standard Penetration Test, bpf **DATE DRILLED:** P = Pocket Penetrometer, tsf WATER LEVEL / SEEPAGE: See Notes U = Unconfined Q = Unconsolidated Undrained Triaxial

FUGRO STD PLATE (AUSTIN) 04.00177602 - ELEVATED STORAGE TANK AT SAN GABRIEL PUMP STATION.GFJ FUGRO AUSTIN DATA TEMPLATE.GDT 12/3/20

# FUGRO STD PLATE (AUSTIN) 04.00177602 - ELEVATED STORAGE TANK AT SAN GABRIEL PUMP STATION.GFJ FUGRO AUSTIN DATA TEMPLATE.GDT 12/3/20

### LOG OF BORING NO. B-2 Elevated Storage Tank at the San Gabriel Pump Station Leander, Texas



				Leander, Texas PROJECT NO. 04.0017760	)2					Fugro	USA L	and, Inc.
DEPTH, FT	SYMBOL	SAMPLES	POCKET PEN, tsf Blows/ft. REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 4 SIEVE, %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	COMPRESSIVE STRENGTH TSF
		À	N = 30	SURF. ELEVATION: 976.0 ft± SANDY LEAN CLAY with crushed limestone, brown to								
	+	$\mathbb{M}$		tan, moist. <i>(FILL)</i>								
-			N = 32	SANDY, SILTY CLAY with GRAVEL (CL-ML), tan, moist, very stiff to hard, with limestone fragments and occasional calcareous nodules.	974.0 2.0							
- - 5 -			N = 26	- w/ increasing limestone fragments below 4 feet.		22	26	5	79	53		
-			N = 50/6"		969.0							
-		<u>-</u>		LIMESTONE, tan, highly weathered, moderately hard,	7.0							
			8'-10' 92 / 40	with occasional clay layers. (Edwards) - highly weathered with sandy, clay layers and ferrous staining from 8 to 11 feet.								
- 10 -			10'-15'									
-			87 / 52									
. 15 -												
- 15 -			15'-20' 100 / 87		960.0							
-	- 1 1		100 / 8/	LIMESTONE, gray, slightly weathered, moderately to highly fractured, dolomatic, moderately hard. (Comanche Peak)	16.0							
20		]										ı
- 20 -			20'-25' 100 / 93									
-		$\exists \parallel$										
- 25 -			25'-30' 100 / 80			3					140	104(U)
-	-											
				DATE DRILLED: N	EY: = Standar = Pocket = Unconfi	Penetr			t, bpf			
					= Uncons		ed Und	draine	d Triax	tial	PLA	TE 5a

# LOG OF BORING NO. B-2 Elevated Storage Tank at the San Gabriel Pump Station Leander, Texas PROJECT NO. 04.00177602

FUGRO STD PLATE (AUSTIN) 04.00177602 - ELEVATED STORAGE TANK AT SAN GABRIEL PUMP STATION.GFJ FUGRO AUSTIN DATA TEMPLATE.GDT 12/3/20

Fugro USA Land, Inc

				PROJECT NO. 04.001776	02					Fugro	USA L	and, Inc.
ОЕРТН, FT	SYMBOL	SAMPLES	POCKET PEN, tsf Blows/ft. REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 4 SIEVE, %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	COMPRESSIVE STRENGTH TSF
		$\frac{1}{1}$	30'-35'	SURF. ELEVATION: 976.0 ft±  LIMESTONE, gray, slightly weathered, moderately to								
		ᆀ	75 / 13	highly fractured, dolomatic, moderately hard.								
]	中	ᅦ	707.10	(Comanche Peak) (continued)								
-	祌	ᅦ		- highly fractured, w/ shaley, clay layers from 30 to 40								
	一	4		feet.								
		ᅦ		Drill Note: loss of stability, increased foam injection used								
1		4		from 30 to 40 feet.								
35 –	$\Box$	4	35'-40'									
}			47 / 13									
]			,									
-{		$\exists \parallel$										
-												
		_										
-		$\exists \parallel$										
40 -		-}	40'-45'			3					146	143(U)
			100 / 83			3					140	143(0
1			100 7 00									
-												
		$\exists \mathbb{H}$										
-		4										
45 –		44			931.0							
				Notes:	45.0							
1				1) The boring was advanced using dry augering to the								
+				depth of 8 feet. Beyond 8 feet, the boring was cored								
_				using air rotary with foam injection to the boring								
				termination depth. Groundwater was not encountered								
1				during drilling. 2) Approximate GPS Coordinates:								
50 –				30.60412°N, 97.81982°W								
				3) Surface elevation was interpolated from USGS								
				topographical maps and should be considered								
-				approximate.								
4												
1												
55 –												
+												
-												
1												
				COMPLETION DEDTIL: 45.0								
				l .	⟨EΥ: ∖ = Standar	d Pen	etratio	n Tesi	t. bnf			
				DATE DIVILLED.	P = Pocket	Penetr	omete	er, tsf	-, ~pı			
					J = Unconfi วิ = Uncons		ed Unc	Iraine	d Triav	ial 🗔	D: 4	·
				UPON COMPLETION: See Notes		Judaic		100	ux		<b>PLA</b>	TE 5b

# FUGRO STD PLATE (AUSTIN) 04.00177602 - ELEVATED STORAGE TANK AT SAN GABRIEL PUMP STATION.GFJ FUGRO AUSTIN DATA TEMPLATE.GDT 12/3/20

# LOG OF BORING NO. B-3 Elevated Storage Tank at the San Gabriel Pump Station Leander, Texas



	PROJECT NO. 04.00177602 Fugro USA La								and, Inc.			
DEPTH, FT	SYMBOL	SAMPLES	POCKET PEN, tsf Blows/ft. REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 4 SIEVE, %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	COMPRESSIVE STRENGTH TSF
	XXX	kc	N = 42	SURF. ELEVATION: 974.0 ft±  SANDY LEAN CLAY with crushed limestone, brown to								
			11 -12	tan, moist. (FILL)	972.0							
			N = 17	SILTY, CLAYEY SAND with GRAVEL, tan, moist, medium dense to very dense, with limestone fragments and occasional calcareous nodules. (SC-SM)	2.0							
5 -		M	N = 20			6	27	5	71	41		
Ū		\ \ \ \	N = 30	- w/ decreasing fines content below 5 feet.		12	25	4	64	24		
			N = 50/1"	LIMESTONE, light brown to tan, soft, moderately	965.5							
10 -			10'-15'	weathered, dolomatic. (Edwards)  LIMESTONE, tan, highly weathered, highly fractured,	964.0 10.0							
			70 / 50	moderately hard, with clay layers. (Edwards)  Drill Note: loss of stability, increased foam injection used from 10 to 20 feet.	10.0							
				VOID from 11 to 13 feet (Drill Note: sudden drop in advancement, loss of stability)	961.0 13.0							
15 -			15'-20'	- weathered clay layers below 13 feet.	958.0	2					155	309(U)
			93 / 52	LIMESTONE, gray, slightly weathered, moderately fractured, dolomatic, moderately hard. (Comanche	16.0							
				Peak)								
20 -			20'-25' 100 / 80									
		I I										
25 -			25'-30' 100 / 67			2					144	126(U)
				DATE DRILLED: N	EY: = Standar = Pocket I	Penetr			t, bpf			
					= Unconfi = Uncons		ed Und	draine	d Triax	kial	PLA <sup>-</sup>	TE 6a

### **LOG OF BORING NO. B-3** UGRO **Elevated Storage Tank** at the San Gabriel Pump Station Leander, Texas PROJECT NO. 04.00177602 Fugro USA Land, Inc. POCKET PEN, ts' Blows/ft. REC./RQD, % WATER CONTENT, % PLASTICITY INDEX (PI), % PASSING NO. 200 SIEVE, % PASSING NO. 4 SIEVE, % DEPTH, FT SAMPLES LIQUID LIMIT, % SYMBOL STRATUM DESCRIPTION LAYER ELEV./ DEPTH SURF. ELEVATION: 974.0 ft± 30'-35' LIMESTONE, gray, slightly weathered, moderately 100 / 68 fractured, dolomatic, moderately hard. (Comanche Peak) (continued) 35 35'-40' 3 97 / 58 40 40'-45' 100 / 53

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Notes:  1) The boring was advanced using dry augering to the depth of 10 feet. Beyond 10 feet, the boring was cored using air rotary with foam injection to the boring termination depth. Groundwater was not encountered during drilling.  2) Approximate GPS Coordinates:  30.60402°N, 97.81968°W  3) Surface elevation was interpolated from USGS topographical maps and should be considered approximate.								
DATE DRILLED:	KEY: N = Standard Penetration Test, bpf P = Pocket Penetrometer, tsf U = Unconfined							
UPON COMPLETION: See Notes	e = Unconsolidated Undrained Triaxial PLATE 6b							

929.0

45.0

COMPRESSIVE STRENGTH TSF

165(U)

UNIT DRY WEIGHT, PCF

147

# FUGRO STD PLATE (AUSTIN) 04.00177602 - ELEVATED STORAGE TANK AT SAN GABRIEL PUMP STATION.GFJ FUGRO AUSTIN DATA TEMPLATE.GDT 12/3/20

# LOG OF BORING NO. B-4 Elevated Storage Tank at the San Gabriel Pump Station Leander, Texas



				Leander, Texas PROJECT NO. 04.001776	02					Fugro	Fugro USA Land, Inc.		
DEPTH, FT	SYMBOL	SAMPLES	POCKET PEN, tsf Blows/ft. REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 4 SIEVE, %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	COMPRESSIVE STRENGTH TSF	
		K	N = 18	SURF. ELEVATION: 975.0 ft± SANDY LEAN CLAY with crushed limestone, brown to									
		$\mathbb{M}$		tan, moist. (FILL)									
			N = 17										
		$\mathbb{N}$			971.5								
- 5 -		M	N = 22	SILTY, CLAYEY SAND with GRAVEL, tan, moist, medium dense to very dense, with limestone fragments and occasional calcareous nodules. (SC-SM)	3.5	15	26	4	62	26			
			N = 50/2"		969.0								
			N = 50/3"	LIMESTONE, tan, highy weathered, highly fractured, moderately hard, with clay layers. (Edwards) - highly weathered, w/ sandy, clay layers and ferrous	6.0								
			8'-10' 63 / 0	staining. from 6 to 11 feet.									
- 10 -			10'-15'	Drill Note: loss of stability, increased foam injection used									
			100 / 48	from 10 to 20 feet.									
- - 15 -			15'-20'	highly weathered we also level from 45 to 20 foot							450	000/11/	
			63 / 0	- highly weathered, w/ clay layers from 15 to 20 feet.		3					153	268(U)	
		<b>=</b>		LIMESTONE, gray, slightly weathered, moderately to	956.0								
- 20 -			20'-25'	highly fractured, dolomatic, moderately hard.  (Comanche Peak)	19.0								
			93 / 45										
		╣											
- 25 -	H	$\prod$	25'-30' 100 / 42			2					143	117(U)	
	井	$\exists \parallel$											
	Ħ	$\exists \parallel$											
		_		DATE DRILLED:	EY:				t, bpf	<u> </u>			
				WATER LEVEL / SEEPAGE: See Notes	= Pocket = Unconfi = Uncons	ned			1 Triav	ial F	D		
				UPON COMPLETION: See Notes	- 51100118	Jiiualt	Ja Onc	ai aii iC(	. 111aX		PLA.	TE 7a	

### LOG OF BORING NO. B-4 **Elevated Storage Tank** at the San Gabriel Pump Station Leander, Texas PROJECT NO. 04.00177602



PLATE 7b

Fugro USA Land, Inc PLASTICITY INDEX (PI), % PASSING NO. 200 SIEVE, % PASSING NO. 4 SIEVE, % COMPRESSIVE STRENGTH TSF POCKET PEN, t Blows/ft. REC./RQD, % UNIT DRY WEIGHT, PCF WATER CONTENT, % DEPTH, FT SAMPLES LIQUID LIMIT, % SYMBOL STRATUM DESCRIPTION **LAYER** ELEV./ DEPTH SURF. ELEVATION: 975.0 ft± 30'-35' LIMESTONE, gray, slightly weathered, moderately to 87 / 30 highly fractured, dolomatic, moderately hard. (Comanche Peak) (continued) Drill Note: loss of stability, increased foam injection used from 30 to 45 feet. - w/ alternating shaley, clay layers below 30 feet. 35 35'-40' 2 145 181(U) 57 / 30 40 40'-45' 83 / 30 930.0 45 45.0 Notes: 1) The boring was advanced using dry augering to the depth of 8 feet. Beyond 8 feet, the boring was cored using air rotary with foam injection to the boring termination depth. Groundwater was not encountered during drilling. 2) Approximate GPS Coordinates: 50 30.60402°N. 97.81968°W 3) Surface elevation was interpolated from USGS topographical maps and should be considered approximate. 55 **COMPLETION DEPTH: 45.0** KEY: N = Standard Penetration Test, bpf **DATE DRILLED:** P = Pocket Penetrometer, tsf WATER LEVEL / SEEPAGE: See Notes U = Unconfined Q = Unconsolidated Undrained Triaxial

**UPON COMPLETION: See Notes** 

FUGRO STD PLATE (AUSTIN) 04.00177602 - ELEVATED STORAGE TANK AT SAN GABRIEL PUMP STATION.GFJ FUGRO AUSTIN DATA TEMPLATE.GDT 12/3/20

### TERMS AND SYMBOLS USED ON BORING LOGS FOR SOIL **SOIL TYPES** FAT CLAY (CH) LEAN CLAY (CL) SILT (ML) Well-Graded Poorly-Graded SILTY SAND (SM) AYEY SAND (SC) SAND (SW) SANÓ (SP) Well-Graded Poorly-Graded SILTY GRAVEL (GM) CLAYEY GRAVEL (GC) **GRAVEL (GW) GRAVEL (GP) SOIL GRAIN SIZE** U.S.STANDARD SIEVE 12" 3" 3/4" 200 10 40 **GRAVEL** SAND BOULDERS COBBLES SILT CLAY **COARSE FINE** COARSE MEDIUM **FINE** 76.2 19.1 4.76 2.00 0.420 0.074 0.002 SOIL GRAIN SIZE IN MILIMETERS STRENGTH OF COHESIVE SOILS **DENSITY OF GRANULAR SOILS UNDRAINED** NUMBER OF BLOWS **RELATIVE** COMPRESSIVE STRENGTH CONSISTENCY PER FT., N **DENSITY** Tons Per Sq. Ft. Less Than 0.25 Very Soft 0-4 Very Loose Soft 0.25 to 0.50 4-10 Loose 0.5 to 1.00 Medium Firm 10-30 1.00 to 2.00 Stiff 30-50 Dense 2.00 to 4.00 Very Stiff Over 50 Very Dense greater than 4.00 Hard DESCRIPTIVE TERMS FOR SOIL (1) DESCRIPTION **CRITERIA MOISTURE** Alternating layers of varying material or color with layers at least 6 mm thick. Stratified Dry No water evident in sample; fines less than plastic limit. Sample feels damp; fines near the plastic Moist limit Laminated Alternating layers of varying Very Moist Water visible on sample; fines greater material or color with the plastic limit and less than liquid limit layers less than 6 mm thick. Wet Sample bears free water; fines greater than liquid limit. Breaks along definite planes of fracture with little resistance Fissured INCLUSIONS (1) to fracturing. Inclusion <1/8" thick extending through Parting Fracture planes appear polished or glossy, sometimes striated. Slickensided sample Inclusion 1/8" to 3" thick extending Seam through sample. **Blocky** Cohesive soil that can be broken Inclusion >3" thick extending through Laver down into small angular lumps which resist further breakdown. sample. Trace <5% of sample. Lensed Inclusions of small pockets of 5% to 10% of sample. Few different soils. Little 15 to 25% of sample. With 15% to 29% of sample.

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E: Information on each boring log is a compilation of subsurface conditions and soil and rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted from commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the times and places indicated, and may vary with time, geologic condition or construction activity.

REFERENCES: 1) ASTM D 2488 2) Peck, Hanson and Thornburn, (1974), Foundation Engineering.

PLATE 8

	ROCK	TYPES		SAMPLER TYPES					
LIMESTON	IE S	HALE	SA	NDSTONE	Thin- walled Tube	Rock Core			
HIGHLY W LIMESTON		IIGHLY WEATHEREI HALE	P	EATHERED NDSTONE	Standard Penetration Test	Auger Sample			
		OLOMITIC IMESTONE	МА	RL	THD Cone Penetration Test	Bag Sample			
SOLU	TION & VOID CONE	DITIONS	W	EATHERING	GRADES OF ROCK	MASS <sup>(1)</sup>			
Void	Interstice; a general terr space or other openings			Slightly	Discoloration indicate weathering of rock mand discontinuity surf	aterial			
Cavities Vuggy	Small solutional concavi Containing small cavitie lined with a mineral of d composition from that or	mall cavities, usually nineral of different		Moderately	Less than half of the rock material is decomposed or disintegrated to a soil.				
Vesicular	surrounding rock.  Containing numerous si cavities, formed by expa bubbles or steam during of the rock.	ımerous small, unlined ed by expansion of gas		Highly  Completely	More than half of the rock material is decomposed or disintegrated to a soil.  All rock material is decomposed and/or				
Porous	Containing pore, intersti	gs which may or may not			disintegrated to soil. The original mass structure is still largely intact.				
Cavernous	Containing cavities or ca sometimes quite large. I in limestones and dolom	averns, Most frequent nites.		Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed.				
	HARDNESS			BEDE	DING THICKNESS (2)	)			
Friable Crumbles under hand pressure Low Hardness Can be carved with a knife Moderately Hard Can be scratched easily with a knife Very Hard Cannot be scratched with a knife			Very Thick       >4'         Thick       2'-4'         Thin       2"-2'         Very Thin       1/2"-2"         Laminated       0.08"-1/2"         Thinly-Laminated       <0.08"						
		JOINT DE	SCRIPTIC	N					
Very Close Close Medium ( Wide	2"-12"	INCLIN/ Horizontal Shallow Moderate Steep Vertical	0-5 5-35 35-65 65-85 85-90	Slicken Smooth Irregula Rough	Planar	ıranular			
JGRO	obtained from th	ach boring log is a co e field as well as from	mpilation of s	sting of samples.	ns and soil and rock classi Strata have been interprete al and approximate in natur	d by commonly			

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 $REFERENCES: \ \ 1) \ British \ Standard (1981) \ \underline{Code \ of \ Practice \ for \ Site \ Investigation} \quad BS \ 5930.$ 

2) The Bridge Division, Texas Highway Dept. Foundation Exploration & Design Manual, 2nd Edition,revised June,1974.

PLATE 9